Honolulu High-Capacity Transit Corridor Project

RFI Information

INFORMATION PACKAGE

SYSTEM CHARACTERISTICS QUESTIONNAIRE
NOTICE TO FIXED GUIDEWAY SYSTEM VEHICLE SUPPLIERS
REQUEST FOR INFORMATION
(RFI 001)

The City and County of Honolulu (City) is currently conducting engineering and technical studies to support the preparation of environmental impact statements (EISs) for the Honolulu High-Capacity Transit Corridor Project (HHCTCP). The HHCTCP's Locally Preferred Alternative (LPA) is a fixed guideway transit system from Kapolei to the University of Hawaii at Manoa and to Waikiki. The Final EIS will focus on the LPA's minimum operable segment (First Project) and must be based on a selected fixed guideway transit vehicle technology. The selected technology will be the basis for any future procurement of fixed guideway vehicles.

To assist the City in evaluating existing technologies, suppliers of fixed guideway transit vehicles are invited to complete the Information Package that accompanies this notice. The Information Package consists of a description of the First Project's systems and vehicle characteristics, and three sets of questionnaires. Information regarding the HHCTCP, its current status, and general alignment of the First Project are available on the web site www.honolulutransit.org.

The City reserves the right to contact respondents for additional generic information. The City also reserves the right to incorporate in a future solicitation for fixed guideway vehicles, if issued, any recommendations presented in the responses to this Request for Information or in any written communications or during any oral discussions with respondents. If the City desires to use proprietary or confidential information submitted by a respondent, the City shall first obtain the written permission of the respondent prior to its use. Other than this obligation regarding the use of proprietary or confidential information, neither the City nor any respondent to this notice has any obligation to the other under this Request for Information now or in the future.

Submittal Requirements

1. Respondent contact information:
   - Name, address, telephone, fax and E-mail of the submitting supplier; and
   - Name, address, telephone, fax and E-mail of the submitting supplier's designated representative.
2. Responses must be clearly marked with the City's RFI number (RFI 001).
3. Specific proprietary or confidential information contained in the responses must be clearly marked as such.
4. Responses to the questionnaires attached hereto are requested to be in electronic format using standard file formats such as Microsoft Word, Excel or PowerPoint or in Adobe PDF equivalents. Drawings should be in an Adobe PDF file format. Hard copies will also be accepted.

INFORMATION PACKAGE

SYSTEM CHARACTERISTICS QUESTIONNAIRE

Deadline and Instructions

1. Submit the completed Information Package no later than Friday, January 11, 2008, 4:00 PM, Hawaii Standard Time.
2. Electronic submittals should be sent to transitmailbox@honolulu.gov. No electronic executable files, e.g. files with .zip or .exe name extensions, will be accepted.
3. Hard copy submittals consisting of one original and five (5) copies should be mailed to:
   Division of Purchasing
   Department of Budget and Fiscal Services
   530 South King Street, Room 115
   City Hall
   Honolulu, Hawaii 96813
4. Direct any inquiry regarding this Request for Information to transitmailbox@honolulu.gov.

MPWaterhouse

MARY PATRICIA WATERHOUSE, DIRECTOR
Department of Budget and Fiscal Services
City and County of Honolulu

ATTACHMENT TO
NOTICE TO FIXED GUIDEWAY SYSTEM VEHICLE SUPPLIERS
REQUEST FOR INFORMATION (RFI 001)

INTRODUCTION

To supplement and expand its understanding of available fixed guideway transit system vehicle technologies, the City and County of Honolulu (City) invites fixed guideway transit vehicle manufacturers and suppliers to submit written materials in response to this RFI describing their particular fixed guideway transit technology(ies) and identifying how the technology(ies) address(es) the fixed guideway systems and vehicle characteristics of the minimum operable segment (First Project) of the Honolulu High-Capacity Transit Corridor Project's Locally Preferred Alternative. The goal of the RFI is to provide the City with detailed information concerning available fixed guideway transit vehicle technologies for use by the City in selecting a technology for the First Project and structuring a potential future procurement for fixed guideway transit vehicles.

The City is not obligated to inform respondents of the reasons for, or the details of, its technology selection. The City reserves the right to incorporate in a future procurement, if issued, any recommendation presented in the responses to this RFI. If the City desires to use proprietary or confidential information submitted by a respondent, the City shall first obtain the written permission of the respondent prior to its use. Other than this obligation regarding the use of proprietary or confidential information, **neither the City nor any respondent to this RFI has any obligation to the other under this RFI now or in the future.**

INFORMATION PACKAGE

The Information Package consists of a description of the First Project's systems and vehicle characteristics and three sets of questionnaires which should be completed in their entirety:

- Technology Characteristics Questionnaire;
- Vehicle Characteristics Questionnaire; and
- System Characteristics Questionnaire.

The City strongly encourages the submission of additional technical or promotional material with the completed Information Package. The additional information may include technical data, photographs, system design drawings, specifications, documentation and narrative descriptions explaining the technical aspects and proven characteristics of the technology, and any modifications to the technology that may be needed to accommodate the First Project's characteristics.

Information on more than one technology may be submitted. A separate Information Package should be completed for each technology. All information submitted will be subject to public disclosure under the Hawaii Uniform Information Practices Act (Hawaii Revised Statutes Chapter 92F) unless clearly marked "CONFIDENTIAL" or otherwise identified as proprietary or confidential information. If specific information is identified as proprietary or confidential, that information will not be subject to public disclosure, unless the respondent has given its written

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permission. All other information not specifically identified as proprietary or confidential information will be subject to public disclosure. The City will not be responsible and a respondent cannot hold the City liable for the disclosure of proprietary or confidential information submitted in response to this RFI that is not properly marked or identified as proprietary or confidential. Blanket-type identification by designating the entire response, whole pages or sections as containing proprietary or confidential information is not permitted and will be invalid.

AR00085366

Alstom Transport

ALSTOM

TRANSPORT

January 23, 2008

Division of Purchasing
Department of Budget and Fiscal Services
530 South King Street, Room 115
City Hall
Honolulu, Hawaii 96813

Reference: RFI 001, Notice to Fixed Guideway System Vehicle Suppliers, Request for Information

ALSTOM Transportation is pleased to submit to the City and County of Honolulu our response to RFI 001, Request for Information for the Honolulu High-Capacity Transit Corridor Project. As required by the Information Package, one electronic copy has been included in this submittal package for you review and evaluation.

As a global leader in the manufacturing of transit systems, ALSTOM believes that it is uniquely positioned to provide a system which is based upon the use of innovative design techniques, service proven technologies, quality suppliers, high quality processes and time efficient manufacturing. ALSTOM understands that an efficient and effective system is critical to the City and County of Honolulu as it prepares to meet the growing transportation needs of the greater Honolulu region in the future.

We at ALSTOM thank the City and County of Honolulu for this opportunity to present our preliminary information for this world-class project. The Honolulu High-Capacity Transit Corridor Project is of the utmost importance to ALSTOM and we are committed to making this project a success.

We appreciate the opportunity to participate in this evaluation process and look forward to working with the City of Honolulu in the future. Should you require further information or prefer a meeting to discuss the project if greater detail we would welcome the opportunity for further discussions.

Sincerely,

Chris Davis
Manager of Business Development
ALSTOM Transportation Inc.

ALSTOM

INFORMATION PACKAGE
Technology, Vehicle and System Characteristics Questionnaire
RFI 001

January 24, 2008

TECHNOLOGY CHARACTERISTICS

I – FUNCTIONALITY

1. **Please provide a brief product description of your system, including any special guideway general arrangements, cross sections and technical details.**

The ALSTOM proposed system is based on a driverless 3-car train using conventional steel wheel rail technology.

2. **Are there any limitations with your system providing the required level of service along the First Project's 20 mile route selected and station spacing adopted? If so, please explain.**

There is no limitation envisioned.

3. **Can your system carry a maximum of 9,000 pphpd during the peak periods? Please provide the number of vehicles per train, number of trains and headways for each case. Also identify the square feet per seated and standing passenger assumed.**

To carry 9,000 pphpd on the First Project route, the proposed system would use 49 three-car trains (not including spare trains and trains in preventive maintenance) at peak periods, operated at 98 second headway. Without using tip-up seats, at 4 standing passengers per m^2, the train capacity is 82 seated and 165 standees. This is based on 4.6 ft^2 per seated, and 2.7 ft^2 per standing passenger.

4. **Can your system deliver an average end-to-end travel time of 40 minutes for the First Project with a 20 second dwell time at each station?**

Yes, this travel time is well within the capabilities of our proposed system.

5. **Can your system accommodate guideway switching and crossing over with 2 minute main line headways? If your system is other than a conventional rail technology, please provide details of the guideway switching apparatus (from an existing operating system) for both turnouts and crossovers, including general arrangement drawings, mechanism details and costs along with times to change routes.**

Our system uses a conventional rail technology. Guideway switching and crossing over can be achieved at 2 minute headways.

6. **If your system is other than a conventional rail technology, please provide a general layout and cross section of an existing storage yard and maintenance facility for a system of similar size and passenger loads.**

Not applicable.

7. **Can your system support future expansions and extensions?**

System capacity can be increased by using longer trains (6 cars), assuming that adequate provisions are made in the passenger station design (platform length) and in the traction power distribution system (size and/or number of transformer-rectifier units, additional substations).

For system extensions, provisions can be made in the First Project design to facilitate continued operation while building these extensions.

8. **Can other manufacturers provide interoperable vehicles in a future procurement? If so, please provide the names of up to four other manufacturers of compatible equipment.**

Our vehicles use standard gauge and conventional steel wheel rail technology that can be provided by many other manufacturers such as Bombardier, Rotem, CAF or Siemens.

9. **Can multiple manufactures provide compatible interfacing systems equipment in a future procurement? If so, please provide the names of up to four other manufacturers of compatible train control/signaling, traction power distribution, propulsion and braking control equipment.**

Propulsion and braking control equipment can be provided by the same manufacturers as Question 8 here above. Train control/signaling CBTC equipment can be provided by Siemens or Alcatel. Traction power distribution equipment can be provided by Siemens, Balfour-Beatty, ACS or Ansaldo.

10. **Would your system comply with federal and state regulations and requirements, including the following?**

- **Americans with Disabilities Act (ADA) ;**

Yes, the ALSTOM System will meet ADA regulations and requirements as applicable to the final system and vehicle design selected.

- **Buy America Act ;**

Yes, the ALSTOM System will meet Buy America requirements although the final vehicle alternative selected for the system may or may not be in complete compliance dependent upon the vehicle design which is utilized.

- **Hawaii Seismic Codes;**

Yes, the ALSTOM System will be built to meet the applicable seismic requirements of the Honolulu environment.

- **Fire Protection and safety evacuation regulations (including NEPA 130).**

Yes, the ALSTOM System will be designed to meet the applicable fire protection and safety evacuation regulations.

11. **What features does your system offer which could reduce the impact of construction?**

Our system is based on standard conventional railway technologies that utilize well-known designs and techniques for infrastructure construction. The use of standard ALSTOM products, for which internal interfaces are mastered, in a system where ALSTOM can use its experience of turnkey projects, will also reduce the potential risks for integration delays.

12. **Provide high resolution digital photograph(s) of your proposed system and proposed vehicles which are currently in service that can be used in presentations and publicly released reports (do not provide artist renderings).**

Pictures of previous version (DT4) attached.

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TECHNOLOGY CHARACTERISTICS

II – COSTS

13. If your system requires a proprietary guideway, please provide a typical list of quantities for piers, beams, walkways and guidance mechanisms for 450 linear feet of dual guideway with a clearance of 20 feet above ground level. (Assumptions should include 150-foot long spans).

Our system does not require a proprietary guideway.

14. Please provide information regarding actual costs of your vehicles and equipment for similar transit systems recently built or in revenue service.

For Hamburg DT5, in December 2006, the contract price was 240 M€ ($340M USD) for 67 trains.

- Are there any unique costs or proprietary technology considerations associated with your technology (positive or negative)? Please explain:

  No.

- Please tell us if your system would reduce the costs associated with right-of-way acquisition and/or reduce the impacts to traffic and the community when compared to an elevated 28 foot wide guideway built on single piers at approximately 150 foot spacing. Please explain :

  For such a system, the 150 foot spacing seems high and we believe that the typical pier spacing would be about 100 foot. As for the guideway width, 28 foot seems adequate and might even be reduced, depending on the maintenance / emergency walkway design (single or multiple, central or lateral).

TECHNOLOGY CHARACTERISTICS

III – TECHNOLOGICAL MATURITY

15. **Has your proposed transit system been proven in revenue service for at least five years? Please provide information and local contacts regarding some of those locations.**

The proposed vehicle (DT5) is an evolution of a design (DT4) that has been proven in revenue service in the city of Hamburg, Germany since 1989.

Contact : Ulrich SIEG, Management Board of Hamburger Hochbahn AG
HOCHBAHN, Steinstrasse 20, D-20095 Hamburg, Germany
Tel: (+49 40) 328 80

16. **Please provide the status of any regulatory approvals required or pending.**

Not applicable.

17. **Please describe to what extent your technology uses proven and recognized off-the-shelf components and sub-components, which have been used in transit applications with similar levels of performance and reliability.**

ALSTOM has unsurpassed experience and expertise in building trains and control systems for metros. We have built one in four metro cars in service today, and our signaling and train control systems run the networks of more than 50 cities across five continents. To achieve this, ALSTOM uses technological platforms and a standardized industrial system in an approach focused on quality and cost optimization.

The ALSTOM proposed system is based on subsystems that have been successfully deployed and are continuously improved. The DT5 vehicle that will be delivered in Hamburg in 2009 is based on the DT4 vehicle that has been in service since 1989.

Our latest CBTC signaling solution, Urbalis, is based on a state-of-the-art communications and radio network, and it will be the train control system for (among other projects) line 2 of the Beijing metro, which will serve the installations for the 2008 Olympic Games and for line 10 of Shanghai metro being constructed ahead of the 2010 Universal Exhibition. It is an evolution of the SACEM solution that has been used since 1988 in Paris, Hong-Kong, Santiago, Istanbul, Mexico, then Urbalis 200 in Delhi, Shangai, Daegu, Incheon, and Urbalis U300 CBTC on Singapore North East Line since 2002.

18. **Please describe the status of the engineering and detailed design of your transit system and identify any technology risks.**

ALSTOM will offer products that are state of the art but do not lead to all the uncertainties that could result from immature technologies. The proposed vehicle and our train control system have solid references and use technology that has been in revenue service for several years, or evolutions of the same that will be put in operation in the next two years.

19. **How do you typically guarantee the long term availability of replacement vehicles, systems equipment, and spare parts, as well as software support?**

ALSTOM vehicles and associated equipment and parts are manufactured utilizing technological platforms and standard designs which are in line with standard industry practice. As technology changes, ALSTOM has the capabilities and expertise to manufacture replacement equipment and parts as technological evolution requires. For a project of this nature ALSTOM typically would provide complete vehicle maintenance for a period of up to thirty years.

ALSTOM

VEHICLE CHARACTERISTICS

1. General

• Electric propulsion :	YES	☒	NO	☐
• High floor :	YES	☒	NO	☐
• Fully automatic train operation (manual back-up)	YES	☒	NO	☐
• Bi-directional vehicles :	YES	☒	NO	☐
• Third rail or equivalent current collection :	YES	☒	NO	☐
• Dynamic braking :	YES	☒	NO	☐
• Regenerative braking :	YES	☒	NO	☐
• ADA compliant:	YES	☒	NO	☐
• Level boarding :	YES	☒	NO	☐
• Crash worthiness compliant :	YES	☒	NO	☐
• Crash worthiness details provided :	YES	☐	NO	☒
• Fire performance to NFPA 130 :	YES	☒	NO	☐
• Emergency evacuation provisions :	YES	☒	NO	☐
• Video monitoring and recording :	YES	☒	NO	☐
• Automatic vehicle location / VMS system :	YES	☒	NO	☐
• Vehicle life : (interior components)			30 years	
• Details of noise mitigation measures provided :	YES	☐	NO	☒
• Vehicle maintenance and diagnostic system :	YES	☒	NO	☐
• High reliability / availability :	_________ mean time between train delays			
• Low mean time to repair :	_________ mean time to repair			
• Expected vehicle life: (carbody)			45 years	
• Automatic passenger counting system :	YES	☒	NO	☐
• Vehicle general arrangement drawings provided:	YES	☒	NO	☐
• Vehicle cross sections provided :	YES	☐	NO	☒
• Vehicle to guideway interface details provided :	YES	☐	NO	☒
• Vehicle static clearance envelope provided :	YES	☐	NO	☒
• Vehicle dynamic clearance envelope provided :	YES	☐	NO	☒
• Vehicle length (over ends of vehicle) :	127.30 ft.			
• Vehicle length (over extended couplers) :	129.79 ft.			
• Vehicle width (maximum carbody) :	8 ft. 6 in.			
• Vehicle width (over door threshold) :	8 ft. 2 in.			
• Vehicle height (maximum)	11 ft. 2 in.			
• Maximum weight per vehicle (empty)	53,800 kg		or 118,600 lb	
• Ergonomic design as specified	YES	☒	NO	☐

2. Performance

• Maximum operating speed :	49.7 mph	
• Maximum acceleration rate :	2.68 mphps	
• Service braking rate :	2.68 mphps	
• Emergency braking rate :	3.36 mphps	
• Minimum horizontal radius curve :	230 ft. (line)	197 ft. (depot)
• Minimum vertical radius curve :	1,641 ft., crest	1,641 ft., sag
• Maximum grade :	5 % for	1,650 ft.
• Maximum sustained grade :	4 %	

3. Passenger Accommodations

• # of wheelchair spaces :	2 spaces (minimum)			
• Number of seats per car :	82 seats + 8 tip-up			
• Number of standees per car at design load of 4 passengers / m^2 (AW2) :	165 standees			
• Total number of passengers per car (seated + standees) at AW2 design load :	247 total passengers			
• Air conditioned :	YES	☒	NO	☐
• PA system with auto-announcer :	YES	☒	NO	☐
• Passenger to OCC communications :	YES	☒	NO	☐
• Destination and passenger information displays:	YES	☒	NO	☐

4. Train Sets

• Capable of coupling to make multicar trains :	YES	☒	NO	☐
• Capable of failed train retrieval :	YES	☒	NO	☐
• Capable of bidirectional operation from each car:	YES	☒	NO	☐

SYSTEM CHARACTERISTICS

1. Superelevation Limits

What are the super elevation requirements of your system?

Maximum cant: 150 mm (that is 11 %), to be introduced on a 1:300 ramp (over a 45 m length)

Please explain:

This value of 11% is a compromise between performance, comfort and safety: allowing maximum speed in curve with reasonable lateral acceleration, keeping in mind the tipping stability, including when the train comes to a halt in that curve. The ramp limits the twisting of the vehicle.

2. Route Geometric Constraints

Does your system meet the following criteria?

- Minimum horizontal radii:
  - Maintenance Facility: 150 ft.; No; 197 ft. (60 m)
  - Elevated Structure: 400 ft.; Yes; 230 ft (70 m)
- Minimum horizontal lengths:
  - Curves: 100 ft.;
  - Tangents: 100 ft.;
  - Spirals: 100 ft.

Our vehicle is designed for the following S-curves:
60m (197 ft.) / 60m with 3m (9.84 ft.) straight section in the depot
100m (328 ft.) / 100m with 5m (16.4 ft.) straight section on main line

- Vertical alignments
  - Maximum station grade: 1 %; Yes.

If not, please explain:

3. Hours of Operation :

Does your system meet the following?

- 4:00 a.m. to 12:00 a.m. service day ;
- 6:00 a.m. to 9:00 a.m. morning peak ;
- 3:00 p.m. to 6:00 p.m. evening peak.

YES ☒ NO ☐

4. **Station Dimensions**

- Platform length: 300 ft. maximum; with all doors on platform?

YES ☒ NO ☐

If not, please explain:

5. **Emergency Evacuation Walkways :**

Does your system meet all of the following criteria?

- Must be along entire guideway;
- Must be accessible from vehicle;
- Minimum evacuation walkway width: 2'-6" ;
- Minimum evacuation walkway height: 6'-8" ;
- Minimum maintenance walkway width: 2'-0" ;
- Minimum maintenance walkway height: 6'-8" ; ;
- Walkway width is clear of the vehicle dynamic envelope;
- Walkway around switches meet state and local requirements.

YES ☒ NO ☐

If not, please explain:

6. **Traction Power :**

- Power : Please provide Voltage and Distribution Configuration;
- Substation spacing: 6,500 ft.;
- Substation size: 2.5 MW.

7. **Train Control /Signal System**

Can your system be supplied with a bi-directional fully automatic train operation with manual back-up?

YES ☒ NO ☐

If not, please explain:

Please provide examples of existing installations in revenue service:

Daego Line 2, South Korea; North East Line, Singapore; Santiago Line 4 and 4A, Chile.

SYSTEM CHARACTERISTICS

8. Communications :

- Radio system : YES ☒ NO ☐
- Passenger communication system to OCC/Operators : YES ☒ NO ☐
- On-board Closed Circuit Television YES ☒ NO ☐
- Fire & Emergency management system YES ☒ NO ☐
- On-board ADA message system YES ☒ NO ☐

9. Noise and Vibration

- Can your system meet or exceed the levels and criteria as established by the FTA Transit Noise and Vibration Impact Assessment Guidance Manual and the goal of 75 dBA at stations?

YES ☐ NO ☒

Please explain how this is achieved:

If not, please explain:

Our vehicle noise level measured in accordance with ISO 3095 at 7.5 m from the guideway centreline, 1.2 m above the rail is 69dBA.

- What noise level is achieved from your system operating on elevated guideway at 55 mph, measured 50 feet from the guideway centreline ?

__________ dBA

Our vehicle noise level measured in accordance with ISO 3095 at 7.5 m from the guideway centreline, 1.2 m above the rail, at 80 km/h is 82dBA.

Cite a location where such a level can be measured:

Test track of Hamburger Hochbahn, Germany.

10. Other Characteristics

Does your system provide the following?

- Fully accessible and meets all ADA requirements, including the regulatory requirements of 49 CFR Part 38, Transportation for Individuals with Disabilities;

YES ☒ NO ☐

- Meets all Buy America requirements ;

  Yes, the ALSTOM System will meet Buy America requirements although the final vehicle alternative selected for the system may or may not be in complete compliance dependent upon the vehicle design which is utilized.

and

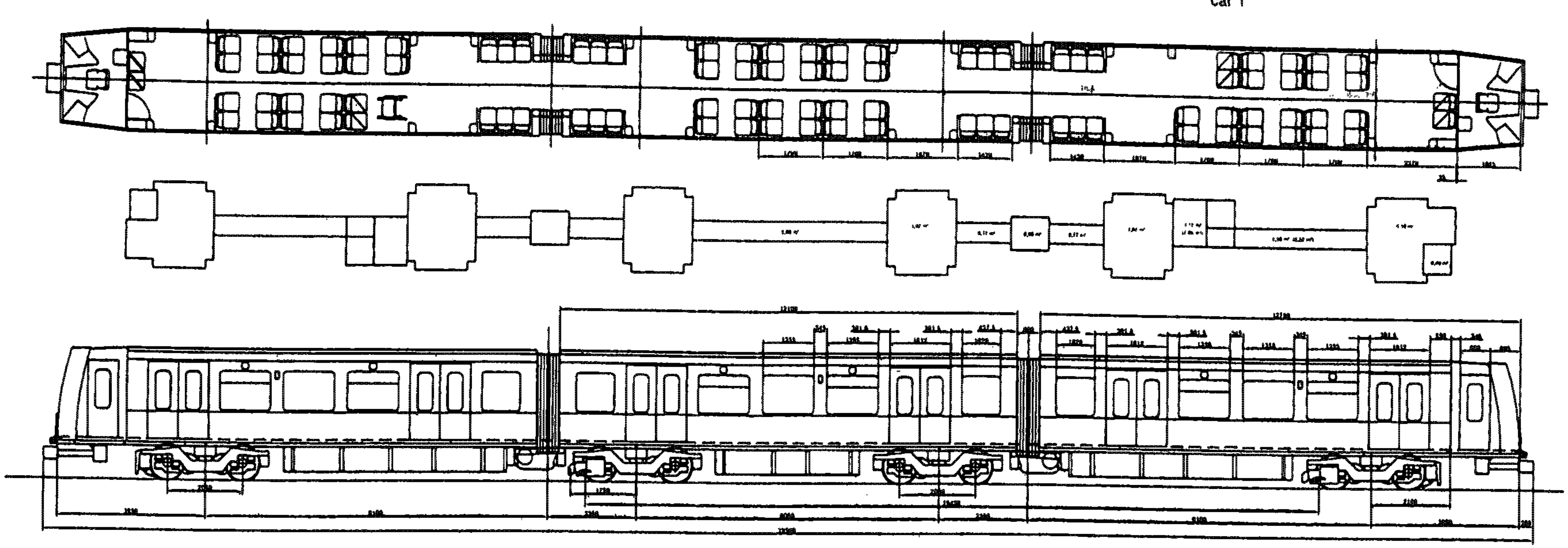
- Cost-effective to operate and maintain

  YES ☒ NO ☐

  If not, please explain:

  Please explain how cost-effectiveness is achieved

  ALSTOM can propose a driverless train for which operation cost is reduced (no driver salary, and flexibility to adapt number of trains in service at any time). ALSTOM can offer a contract for maintenance of its system. ALSTOM can perform RAMS studies to optimize investment cost and Life Cycle Cost of the whole transportation system.



Only for information

Not aplicable for scope of delivery

ZEICHNUNG DARF NUR IM AUTOCAD-SYSTEM GEAENDERT WERDEN

Maßstab 1:120 (A3)

DT5 3-car unit

ALSTOM LHB GmbH

Uebersicht DT5 3-teiler_Vers0.1.1_G_lang.dwg

AnsaldoBreda

Information Marked Proprietary

Information not supplied

FIXED GUIDEWAY TRANSIT SYSTEM FOR HONOLULU HIGH-CAPACITY TRANSIT CORRIDOR PROJECT

RFI 001

PREPARED FOR:

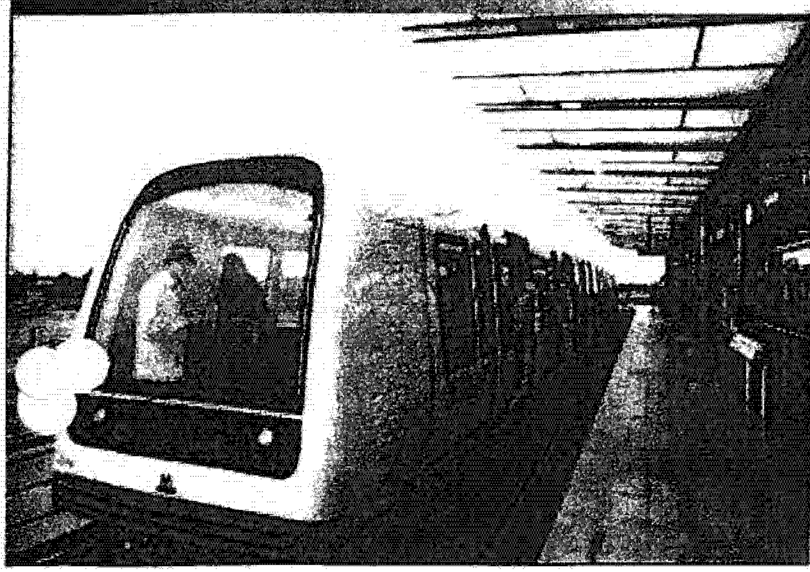
CITY AND COUNTY OF HONOLULU

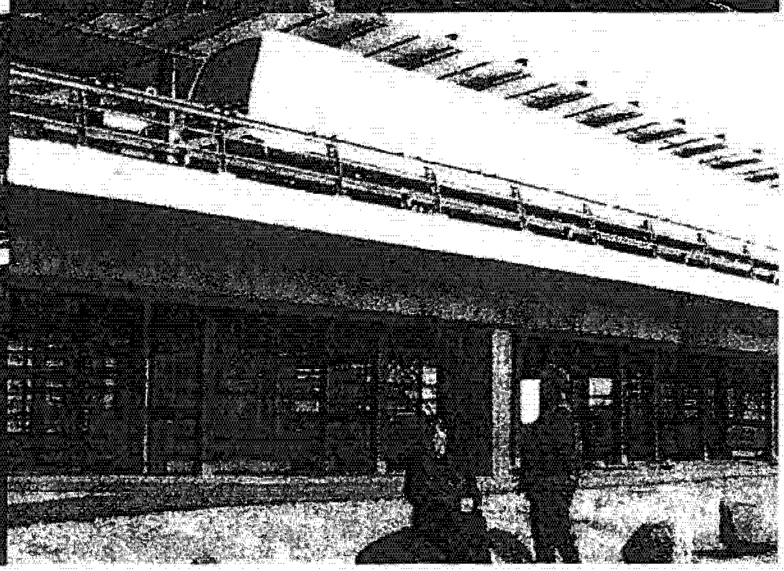
SUBMITTED BY:

ANSALDO STS UNION SWITCH & SIGNAL

JANUARY 24, 2008

AnsaldoSTS
Union Switch & Signal





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AnsaldoSTS
Union Switch & Signal

REQUEST FOR INFORMATION
Fixed Guideway Transit System
Honolulu High-Capacity Transit Corridor Project
RFI-001

Submitted to

City and County of Honolulu

Submitted by

Ansaldo STS Union Switch & Signal

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Ansaldo STS Union Switch & Signal

1000 Technology Drive, Pittsburgh, PA 15219-3120

January 24, 2007

APTS

APTS Advanced Public Transport Systems bv

January 24, 2008

Ms. Mary Patricia Waterhouse
Director
Department of Budget and Fiscal Services
City and County of Honolulu
530 South King Street
Honolulu, Hawaii 96813

Director Waterhouse:

Thank you for the opportunity to present our response to your Department's "Request for Information (RFI-001)" relating to the "Honolulu High Capacity Transit Corridor Project". We believe Advanced Public Transportation Systems (APTS) is uniquely qualified to provide the technology and the support systems required to build and operate a convenient, cost-effective and comfortable fixed guideway transit system for the residents of and visitors to Honolulu.

I am confident we have provided you with the responses you need to accurately assess what we have to offer. If you or your consultants have any questions, or need more information please do not hesitate to contact me or the APTS representatives in Honolulu.

I like to say that one of the characteristics of all great cities is a great public transit system. APTS can provide Honolulu with the kind of system we can all be proud of; a system that will add to the greatness of Honolulu.

Aloha and Mahalo,

Jos C. Jansen
Manager, Marketing and Sales

Steenovenweg 1
NL-5708 HN Helmond, Netherlands
Tel: 0031 492 562456
Fax: 0031 492 562338

APTS Representative Hawaii:
HSK Hawaii Inc., Robert Lee
1050 Queen Street, Suite 202
Honolulu, Hawaii 96814
Tel: 001.808.591.8801
Fax: 001.808.348.6677

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Advanced Public
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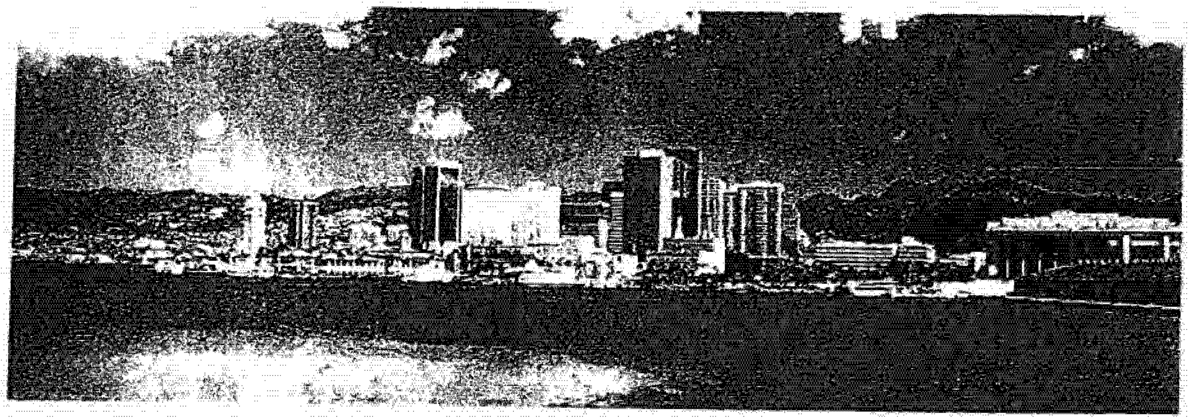


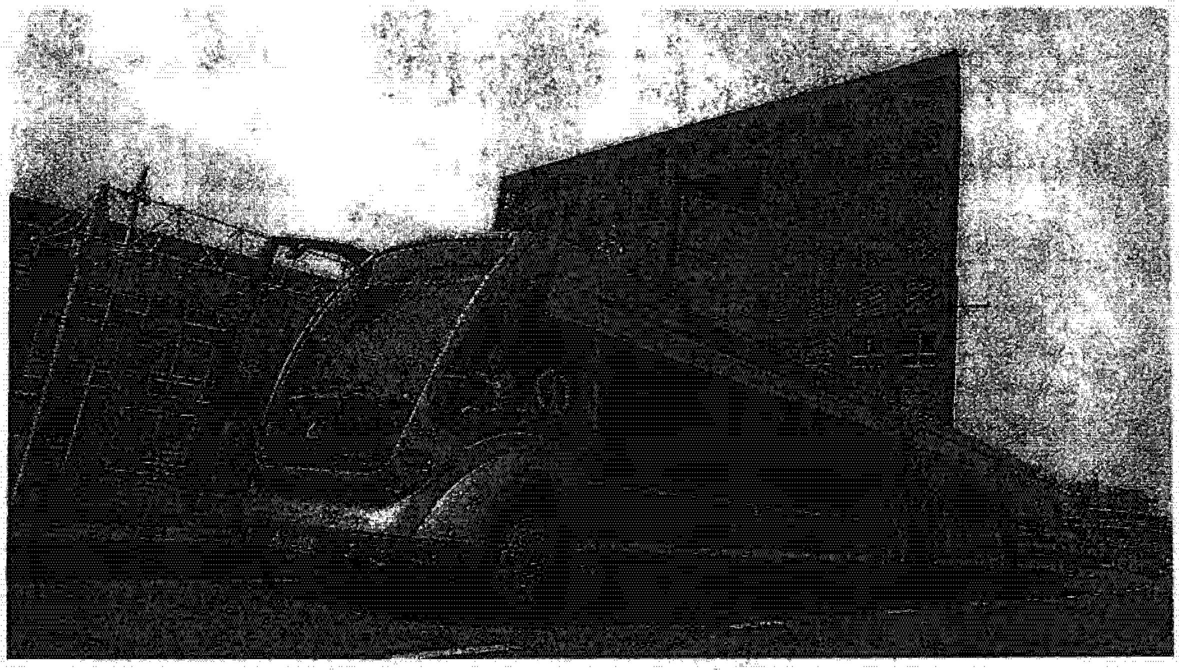
Reply to RFI-001 of City & County of Honolulu

I. Functionality

1. Brief product description.

Introduction

Despite serious congestion and pollution the popularity of the car keeps increasing. This situation can be eased by an appropriately designed public transit system. A system technologically advanced, convenient and comfortable. The APTS system is all of this and more.



24 meter Phileas at the Flight Forum in Eindhoven

a) System advantages

The system advantages for a high quality GRT (Guided Rapid Transit) system are a combination of the advantages of a traditional rail transit system or electric tram with the flexibility and cost effectiveness of a bus system. APTS used the following requirements for the development of their GRT system.

AR00085390

- time efficient
- high average speed
- high frequency
- reliable
- comfortable
- providing good passenger information
- low cost and highly flexible
- futuristic and innovative
- environmentally friendly

Advanced Public Transport Systems BV (APTS) translated these system requirements into a high quality GRT vehicle, named Phileas, after the main character, Phileas Fogg, from the novel *"Around the World in 80 days"* by Jules Verne. This name was chosen as an acknowledgement of speed at which this innovative transit vehicle operates.

b) Vehicle characteristics

Exterior and Interior Design

The Phileas exterior design can compete with the newest light rail vehicles on the market. As a result of the sandwich body construction, the surface quality of the exterior is good. Also APTS has the possibility to adapt the front of the Phileas to special customer's requirements.

The interior features a low floor that is 100% flat, suspended seats, large doors and spacious, client specified seating arrangements. Furthermore, the doors can be positioned on both sides of the vehicle at client specified locations. The result is a vehicle that is rider-friendly and which also has excellent seating and accessibility characteristics for the elderly, the disabled, the wheelchair users, those travelling with small children and bike riders.

The driver's cabin has been designed according to the latest ergonomic standards and has been equipped with a sliding door. The vehicle is equipped with a visual and audible passenger information system and is capable of using an electronic ticketing system.

Floor space is maximised because the front axle is located under the driver's cabin, the rear axle is integrated in the engine compartment and intermediate axles are as close as possible to the articulated section. Also, because Phileas has all-wheel steering, the articulation is shorter than in normal articulated vehicles, this means Phileas 85 feet has only two pair of wheel arches in the passenger compartment. And finally, since the seats are suspended at the sidewalls, the floor can be cleaned in less time, resulting in lower maintenance costs.

<u>Light weight body</u>

The Phileas vehicle features modular, lightweight body construction. The use of composite body panels as structural body parts has a number of advantages.

- integration of strength, rigidity, isolation and finishing
- low weight means higher payload and less vehicles
- no corrosion
- extensive styling freedom, even for low quantity vehicle runs

The use of composite body panels is a proven technology with extensive application in the aerospace and defence industries. Side, front, traction and rear modules of the body shell are sandwich construction using glass-fibre or carbon reinforced plastic with a polyurethane foam core. The modules are produced by Resin Transfer Moulding (RTM). The roof and the floor are aluminium sandwich panels running the full length of the body compartment. All modules are bonded together to form a monocoque cocoon. This "cocoon" meets all isolation, fire resistance and recycling requirements. Crash tests proved a superior resistance against side-impact accidents and an almost service free lifetime of at least 25 years is guaranteed for the Phileas body.

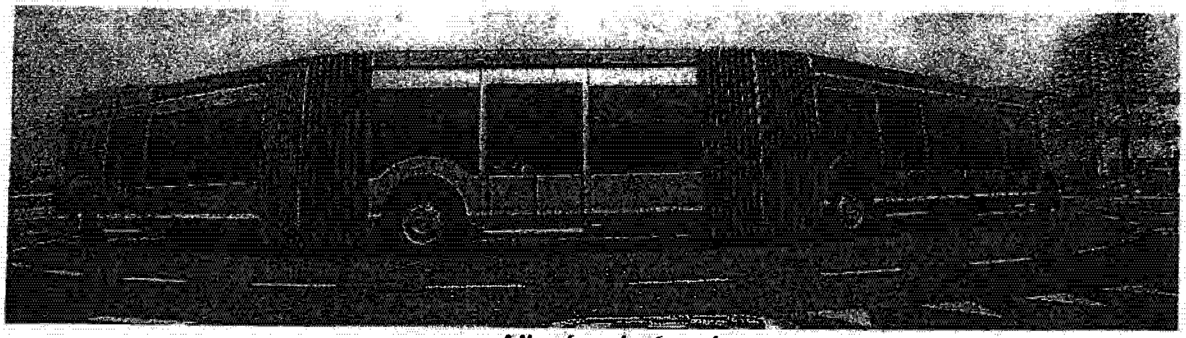
<u>All-wheel steering</u>

One of the major design innovations of Phileas is all-wheel steering. This feature provides Phileas with excellent drive characteristics and sets it apart from all other similar transit vehicles.

In the automatic mode, an on-board computer controls the wheels. Docking Phileas is always done in this mode. And, because all wheels are steering in the same direction, Phileas approaches a station parallel to the platform.

In manual mode the steering angle of the second axle is a ratio of the first axle and the steering angle of the third and fourth axle are dependent on the turning angle of the articulation.

The turning radius of Phileas is less than 40 feet and, more important, the swept path is less than 14 feet, because of the all-wheel steering and the positioning of the wheels.



All wheel steering.

Guidance

Phileas vehicle uses a computer based electronic guidance system that uses magnetic markers every 13 to 16 feet as reference points. This allows Phileas to drive automatically at speeds up to 55 mph under all weather conditions. In operation the vehicle is very stable and requires smaller than average lane width. The required width is approximately 21 feet for a two-way dedicated lane guideway.

There are three available driving modes.

- Automatic where the vehicle is braking, giving throttle and steering
- Semi-automatic where the driver is giving throttle and braking and steering is automatic
- Manual where the driver is giving throttle, braking and steering

The magnets serve three purposes.

- Reference; if while in automatic or semi-automatic mode, as a result of because load, side-wind or slipping, the vehicle deviates from its programmed route it is automatically corrected by the guidance system
- Safety; if, in automatic or semi-automatic mode, the vehicle deviates more than 5-7 inches of the programmed route, the vehicle stops automatically (The amount of accepted deviation can be adjusted)
- Position fixation; the vehicle always knows its position. This information is used for the on-board passenger information and for the central control purposes

Hybrid drive-line

Phileas is designed with a modular GM-Allison parallel electric-hybrid drive-line and is equipped with a Euro 4 diesel engine (Cummins ISL 330) and a nickel metal hydride battery package. This design has a number of advantages.

- Gradual acceleration and deceleration means a more comfortable riding and driving experience
- Low (less than 14 in.), continuous and flat floor throughout the vehicle
- Simple construction
- Low weight
- Low emissions
- Low noise level
- Low fuel consumption
- Optimal weight distribution
- Single supplier for the entire propulsion system
- Proven system with over almost 65 million drive miles in the United States by over 600 single articulated vehicles. (as of December 2007).

Comfort

The electric driveline enables the vehicles to accelerate and brake in a very smooth and gradual manner. This coupled with the larger than usual distance between axles and the fully independent suspension gives Phileas outstanding drive stability.

Accessibility

The design of the door systems and the flexibility of placement combined with a continuous flat floor results in a vehicle that is rider-friendly and also has excellent accessibility characteristics for the elderly, the disabled, wheelchair users, those travelling with small children and bike riders.

Passenger information system

Riders expect service to be high-speed, frequent and on-schedule. They also want seamless connections with other forms of transport. The control system optimises this process and ensures that the vehicles travel at optimum intervals. The electronic guidance system provides accurate real time vehicle positioning which can be displayed in the vehicle and on the station platforms.

2. Limitations in the level of service

None

3. Capacity of the system

Based on 6 people/m^2, the capacity of the 26m (85 feet) Phileas vehicle is 212 passengers; 170 standees, 2 wheelchair positions and 40 seated. Given headway 1 minute and 20 seconds, 80 vehicles (excluding spares) would be required for capacity of 9,000 pphpd.

4. End-to-end travel time < 40 minutes

Based on our calculations the end-to-end travel time would be approximately 40 minutes.

5. Guide way switching and crossing

No special requirements.

6. Storage yard and maintenance facility

Phileas does not require a special facility. The existing bus maintenance and storage facilities can be used.

7. Future expansion and extensions

Phileas system can easily accommodate future expansions and extensions. In fact, since the system is designed to operate in a fixed guideway and on surface streets, the system can be expanded without an elevated, dedicated guideway.

8. Interoperable vehicles on the same infrastructure

The design of the elevated fixed guideway for a Phileas system would be very similar to an elevated highway. As a result is it possible for other vehicles to use the infrastructure. However, since the current plan appears to stipulate a closed-loop quideway system, we anticipate the quideway would be used by other vehicles only under extreme circumstances such as an emergency. In that case emergency vehicles, such as ambulances, police cars and fire trucks can use the Phileas infrastructure.

9. Compatible interfacing system equipment manufacturers

Compatible system manufactures include Peek, Balfour Beatty Rail, Agile Communication Systems.

10. Federal and state regulations and requirements

The Phileas system will fulfil all the applicable Buy America requirements.

11. Features to reduce the impact of construction

Phileas is a lightweight vehicle with a very small turning radius and a very small swept path. It also a small dynamic envelope and requires a small width of the track. The vehicle can be shifted into manual mode when it has to pass a stalled vehicle and as a result does not need a 3rd track.

All these features mean Phileas requires a much smaller construction footprint when compared to light or heavy rail systems. A smaller footprint equals less impact.

12. High resolution digital photographs of the Pihleas vehicle

Photographs of the vehicle are available in high resolution and will be sent under separate cover.

II. Costs

13. Quantities for 450 feet of dual guide-way, 20 feet above ground level

Our vehicle can be used on a proprietary guide-way, but this is not required. The vehicle can use any dual guide-way 20 ft above the ground.
When the vehicle drives in the guided mode, it follows a pre-set route in the computer, just like it is following a virtual rail. The system will have a safety level comparable with a bullet train.

The vehicle can be put in manual mode in case it has to pass a stalled vehicle.

The axle load will never exceed 22,850 lbs, which means that the construction of the elevated guide-way will be much lighter and cheaper than construction for a light or heavy rail system.

14. Actual costs of vehicle and equipment

The vehicle costs depend on the length and the included options, and vary between $1,650,000 and $1,975,000.

The project costs depend on the location, the size of the project, the additional design requirements and the set-up of a local production facility to meet the "Buy America Act". These costs will be between 10% and 15% of the total vehicle costs (> 50 vehicles contract).

Vehicle related infrastructure will be approximately $ 375,000 per mile for a double track system including placement and geometric measurement of the magnets and development of the required computer software.

Phileas does not need an overhead electrical wire or a fixed rail. Also the weight of our system is much lower than train systems. As a result, when compared to light or heavy rail, the Phileas infrastructure can be built at significantly less cost.

In summary, in comparison to rail-guided vehicle systems Phileas is more flexible, lighter in weight, can handle steep slopes, requires less energy, is more comfortable and costs much less to design, build and operate.

III. Technological Maturity

15. Proven in revenue for at least 5 years

The development of our system started in 1999 and has been tested in Eindhoven since 2001. In 2004 service started with passengers.

In the meantime the vehicle development continued and in 2006 the first second (2nd) generation Phileas was introduced. This vehicle has been tested miles and will now be introduced for service in Turkey and at the end of the 2008 in Douai in the North of France. The experience with the second (2nd) generation Phileas is very positive.

Based on these results we signed recently a contract with the Region of Eindhoven (The Netherlands) to convert all vehicles in Eindhoven into the second (2nd) generation Phileas during 2008.

The two main Phileas systems are the parallel hybrid propulsion system of GM Allison and the guidance system of FROG Navigation Systems.

Allison is well known in America. In the United States, 70 operators including Honolulu use the system in over 700 single articulated buses. It is a very reliable system.

The FROG system used in Phileas is based on the same principle as AGV vehicles, people movers and container transport vehicles. These vehicles have been in service over 15 years in locations all over the world.

Phileas vehicles are sold in Eindhoven (NL), Douai (F), Istanbul (TR) and Pescara (I) and South Korea has entered in a license agreement for Phileas and plans to build 600 vehicles for use in Korea. Below is an overview of our projects including customer names and contact information.

Samenwerkingsverband Regio Eindhoven Project

Project Name and Location:	**Samenwerkingsverband Regio Eindhoven (SRE)**
Client Name/Address/Contact Person/ Telephone Number:	Theo Dijk Keizer Karel V single 8 5615 PE Eindhoven The Netherlands Telephone: +31 40 259 4594 Fax: +31 40 259 4599
Project Start/Completion Dates:	January, 1999/June, 2006
Contract Amount:	$48.5M (U.S.)
Vehicle Quantity:	12 Total (11 ea - 18 meter length and 1 ea – 24 meter length)
Comments/Description	This program included further development of the Phileas concept and the production of 12 Phileas vehicles for the region of Eindhoven in the Netherlands. Successful planned integration and testing activities are currently underway with full 'guided' driving operation beginning in mid-2006.The vehicles are currently in manual mode operation.

Syndicat Mixte des Transports Douaisis Project

Project Name and Location:	**Syndicat Mixte des Transports du Douaisis**
Client Name/Address/Contact Person/ Telephone Number:	Bernard Delporte 395, boulevard Pasteur F-59287 Guesnain France Telephone: +33 3 2799 1999 Fax: +33 3 2787 4578
Project Start/Completion Dates:	January, 2005/November, 2007 (anticipated)
Contract Amount:	18 Million (U.S.)
Vehicle Quantity:	12 ea (18 meter length)
Comments/Description	The development of the second generation consists of Phileas vehicles with a safety level for trams, a new front and a new body (6 doors).

Korea Railroad Research Institute Project

Project Name and Location:	**Korea Railroad Research Institute - KRRI (a governmental research institute)**
Client Name/Address/Contact Person/ Telephone Number:	Mok Jai-Kyun #374-1, Woulam-Dong Uiwang-City, Kyonggi-Do, Korea 437-050 Telephone: +82 31 460 5727 Fax: +82 31 460 5499
Project Start/Completion Dates:	January, 2006/December, 2009 (anticipated)
Contract Amount:	5.8 Million (U.S.)
Vehicle Quantity:	500 (anticipated)
Comments/Description	This program will involve extensive technology transfer of the Phileas concept. Based on the Phileas concept, the KRRI plans to ultimately develop a Korean tram on rubber tires utilizing a fuel cell propulsion system.

İ.E.T.T. İŞLETMELERİ GENEL MÜDÜRLÜĞÜ of Istanbul

Project Name and Location:	**İ.E.T.T. İŞLETMELERİ GENEL MÜDÜRLÜĞÜ**
Client Name/Address/Contact Person/ Telephone Number:	Mehmet Öztürk, General Director Erkan-I Harp Sk. No.4 Metrohan, Tünel, Beyoğlu, Istanbul Telephone: +90 212 245 0720 Fax: +90 212 252 1017
Project Start/Completion Dates:	January, 2007 / End of 2008 (anticipated)
Contract Amount:	90 Million (U.S.)
Vehicle Quantity:	50 ea (26 meter length)
Comments/Description	The development of the second generation consists of Phileas vehicles with a safety level for trams and a new body length (26m).

Gestione Transporti Metropolitani S.p.A. in Pescara, Italy

Project Name and Location:	**Gestione Transporti Metropolitani S.p.A.**	
Client Name/Address/Contact Person/ Telephone Number:	Dr. Fabiani Via Atemo n. 255 I-65128 Pescara Italia	Telephone: +39 (0)85 43212 Fax:
Project Start/Completion Dates:	October 2007 / March 2010 (anticipated)	
Contract Amount:	14 Million (U.S.)	
Vehicle Quantity:	6 ea (18 meter length) trolley version	
Comments/Description	The development of the trolley version (streetcar) consists of Phileas vehicles with a new trolley propulsion system of Vossloh-Kiepe.	

16. Status of regulatory approvals

The Phileas vehicle is homologated (officially certified) according to the European law for buses. In addition to that homologation (official certification of), the guidance system will be approved according to regulations EN50126, EN50128 and EN50129. These regulations define the safety level of transportation systems.

Finally, safety certification requires that Phileas experience less then 1 person killed by technical vehicle failure in 10,000 years. We expect to reach the certification in the beginning of 2009.

17. Using off-the-shelf components

As much as possible, Phileas uses off-the-shelf components. For example we currently use the following off-the-shelf systems.

- Knorr brake systems
- Mobil Electronic all wheel steering

- VDO dashboard system
- Standard bus tires
- ZF front axle
- Ventura sliding door systems

The drive-line is an Allison hybrid.

18. Technological risks

Unknown at this time.

19. Guarantee long term availability

Phileas guarantees long term availability.

Vehicle characteristics questionnaire

1. General:

- Electrical propulsion — YES

  Remark: Diesel-Hybrid Allison or Trolley Vossloh-Kiepe

- High floor — NO

  Remark: 100% low floor

- Fully automatic train operation (manual back-up) — YES

  Remark: Possible but not at 55mph

- Bi-directional vehicles — Not Applicable

  Remark: All Wheel Steering system, omni directional. Phileas is active steering system, where rail is passive, confined to rail track. Small turning and lateral movement.

- Third rail or equivalent current collection — YES/NO

  Remark: Only the trolley version

- Dynamic braking — YES

- Regenerative braking — YES

- ADA compliant — YES

  Remark: The vehicle will be adapted to this requirement

- Level boarding — YES

  Remark: The platform level is 12 inches from the road surface

- Crash worthiness compliant — YES

  Remark: Composite body and tested according European law

- Crash worthiness detail provided — NO

- Fire performance to NFPA 130 YES

  Remark: Fire performance to NF16101-NF16102 (High speed trains)

- Emergency evacuation provisions YES

  Remark: Because of composite body, it is even possible to have doors on two sides. This can be used as emergency exits or to optimize the position of the stops.

- Video monitoring and recording Local supplier

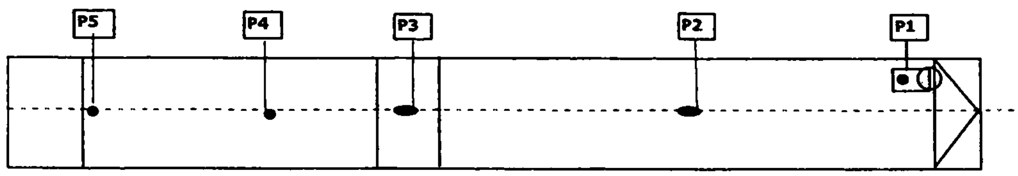
- Automatic vehicle location / VMS system Local supplier

- Vehicle life >20 years

- Details of noise mitigation measures provided YES

Table of noise measurement in the interior on asphalt and concrete (béton) lane:

	Vitesse 0 km/h		Vitesse 20 km/h		Vitesse 40 km/h		Vitesse 60 km/h		Vitesse 80 km/h	
	asphalte	béton	asphalte	béton	asphalte	béton	asphalte	béton	asphalte	béton
Position P1	52,0		57,0	59,0	65,0	67,0	68,0	70,0	73,0	76,0
Position P2	54,0		61,0	62,0	69,0	72,0	73,0	75,0	78,0	83,0
Position P3	59,0		65,0	67,0	70,0	73,0	76,0	79,0	79,0	84,0
Position P4	63,0		68,0	69,0	71,0	74,0	75,0	76,0	77,0	81,0
Position P5	63,0		68,0	71,0	71,0	74,0	75,0	76,0	76,0	80,0



- Vehicle maintenance and diagnostic system YES

- High reliability / availability YES

  Remark: No information yet on 2nd generation vehicle, but of the propulsion supplier Allison.

- Low mean time to repair YES

  Remark: No information yet on 2nd generation vehicle, but of the propulsion supplier Allison.

- Expected vehicle life Long

  Remark: Composite body has no corrosion

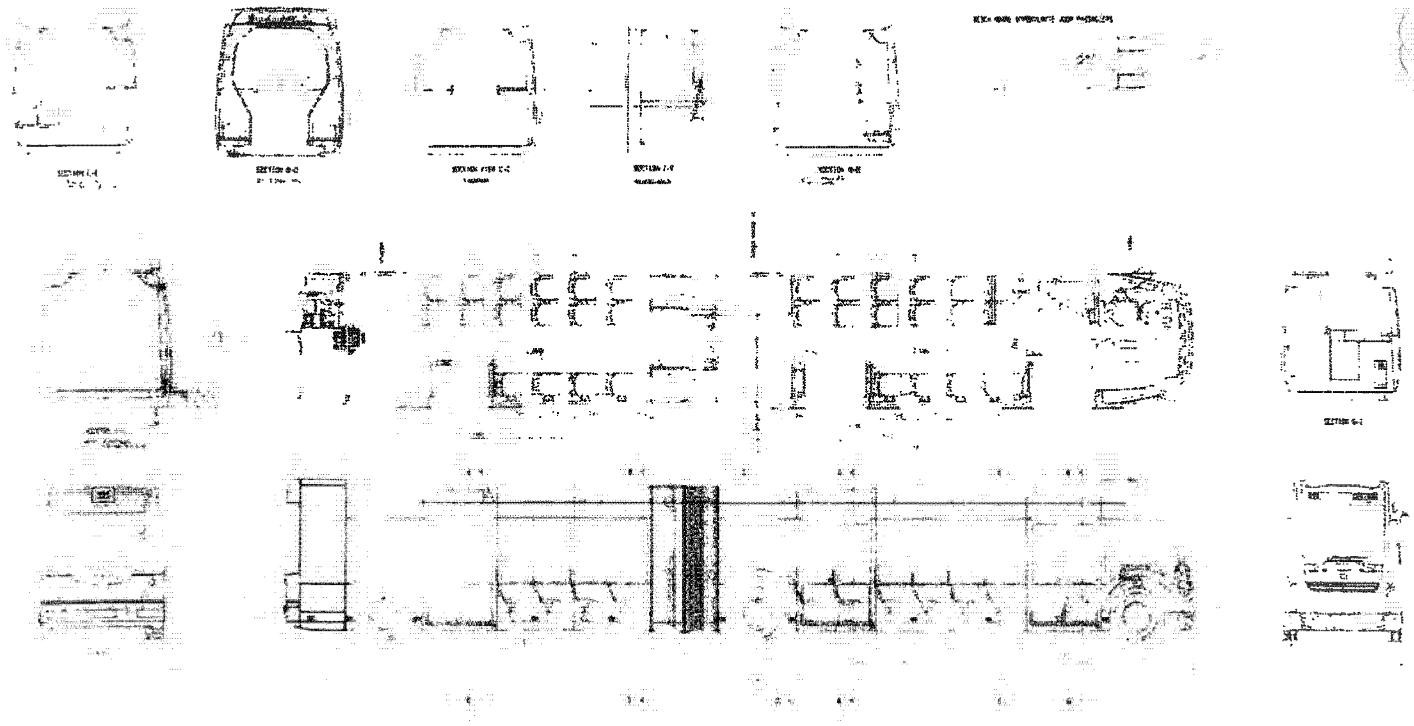
- Automatic passenger counting system: Local supplier

- Vehicle general drawings provided YES

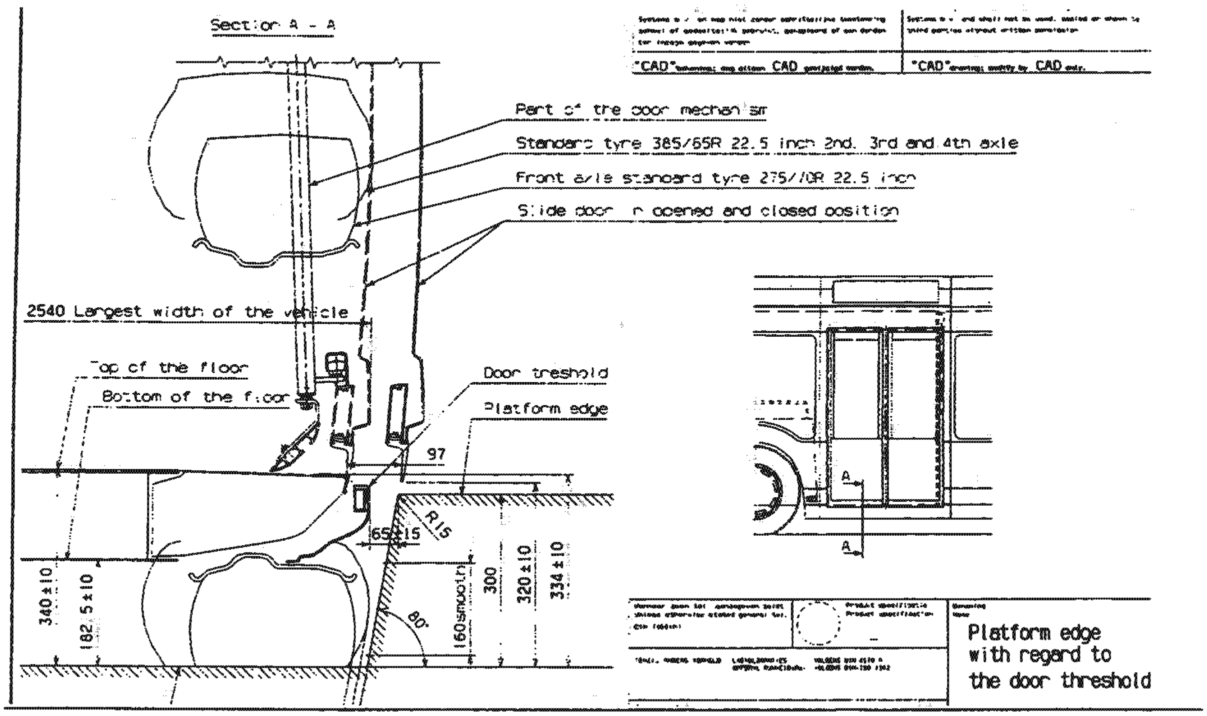
  Remark: Interior can be adapted to customer wishes, because of the modularity of the vehicle

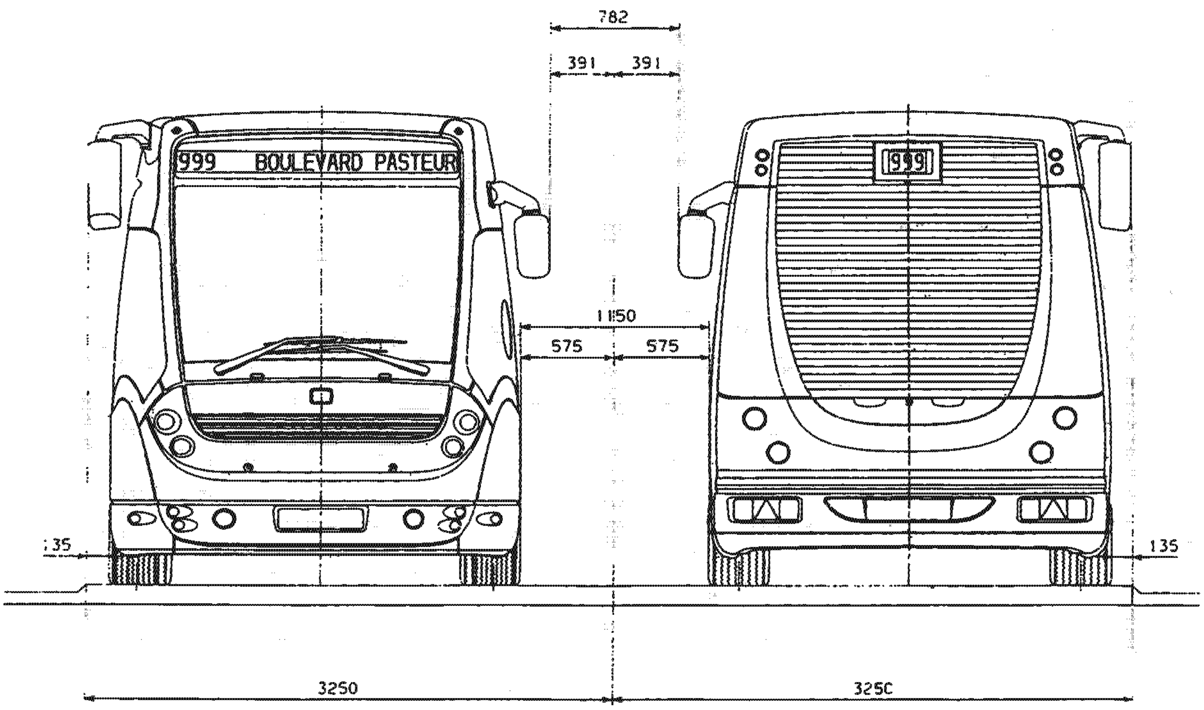
- Vehicle cross sections provided YES

The cross sections for a 60 ft Phileas (85 ft Phileas has the same sections):



- Vehicle to guide-way interface details provided YES





- Vehicle static clearance provided YES

- Vehicle dynamic clearance envelope provided YES

Remark: Road width can increase according to speed, corners and infrastructure quality

Dynamic envelope of the Phileas with computer guidance on a double lane:

The information regarding the envelope of the Phileas is a summary of the calculations of the envelope for the safety certification in France. In those calculations you take in account all the possible dynamic disturbances from outside the vehicle and the accuracy of the guidance system and wheel suspension.

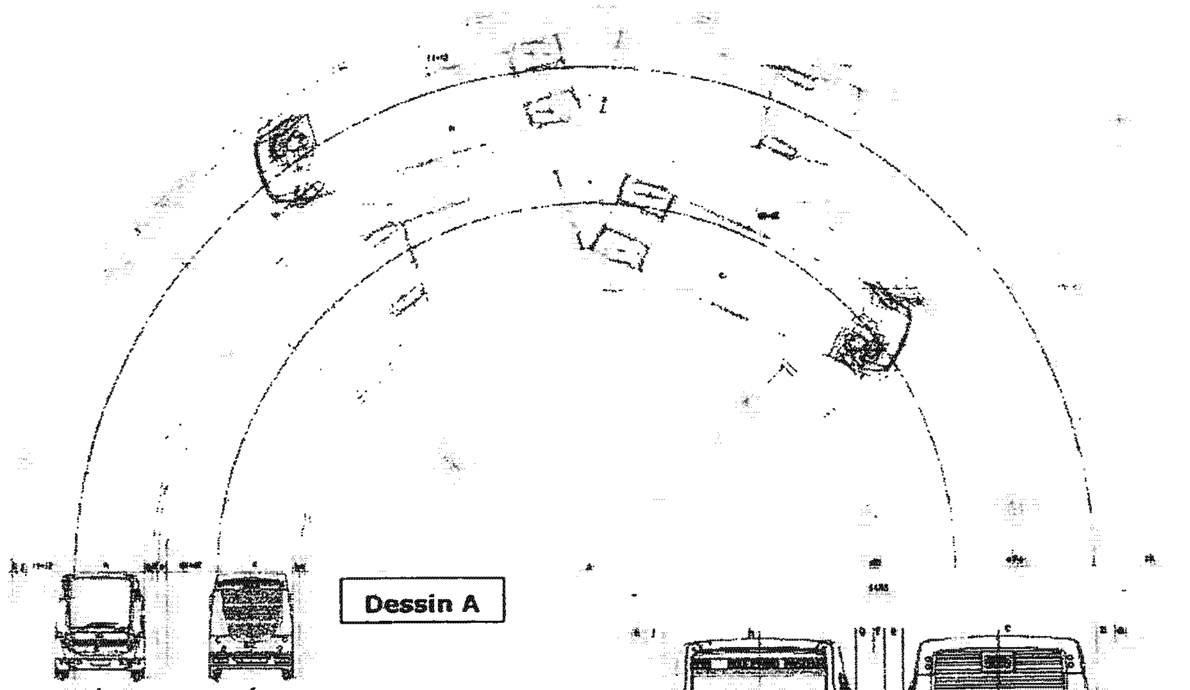
Dynamic influences are:

- ☐ Wind 37.2 mile/h gives a lateral acceleration of 1.64 ft/sec².
- ☐ Centrifugal forces in curves at a lateral acceleration of 3.94 ft/sec².
- ☐ Suspension movement caused by the elasticity of the suspension
- ☐ Influence of the tires like flat tire, wear and punctured.
- ☐ Deviation of the guidance system

In the following summary of the Phileas envelope the sense of the abbreviations is:

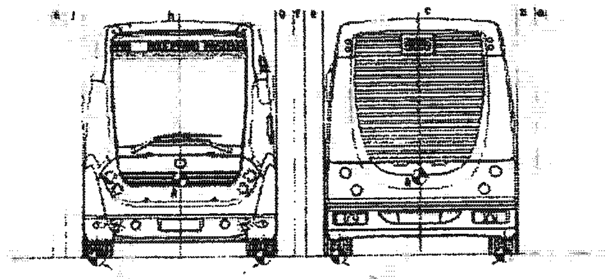
- ☐ a, f, and k = safety margins
- ☐ b, e, g and j = the sum of the disturbances mentioned above
- ☐ c and h = width of the vehicle
- ☐ d1 + d2 and i1 + i2 = swept path minus the width of the vehicle

radius of magnets (m)	1,20 m/s2	vehicle 1							vehicle 2					
	km/h	mm a	mm b	mm c	mm d1+d2	mm e	mm f	mm g	mm h	mm i1+i2	mm j	mm k	mm	
11,01	13	150	239	2.550	1.150	243	150	263	2.550	826	260	150	8.531	15,10
12,50	14	150	239	2.550	1.000	243	150	263	2.550	769	260	150	8.324	16,51
15,00	15	150	239	2.550	830	243	150	263	2.550	674	260	150	8.059	18,90
20,00	18	150	239	2.550	630	243	150	263	2.550	525	260	150	7.710	23,75
25,00	20	150	239	2.550	490	243	150	263	2.550	439	260	150	7.484	28,65
30,00	22	150	239	2.550	420	243	150	263	2.550	384	260	150	7.359	33,59
35,00	23	150	239	2.550	370	243	150	263	2.550	335	260	150	7.260	38,55
40,00	25	150	239	2.550	320	243	150	263	2.550	299	260	150	7.174	43,51
50,00	28	150	239	2.550	260	243	150	263	2.550	251	260	150	7.066	53,46
100,00	39	150	239	2.550	130	243	150	263	2.550	128	260	150	6.813	103,33
200,00	56	150	239	2.550	70	243	150	263	2.550	68	260	150	6.693	203,27
?	max 60	150	235	2.550	0	239	150	239	2.550	0	235	150	6.498	?
?	max 30	150	176	2.550	0	180	150	180	2.550	0	176	150	6.262	?



Dessin A : Envelope Phileas in a curve

Dessin B: Envelope Phileas on straight road



Dessin B

- Vehicle length	60.7, 80.5 or 85.4 ft
- Vehicle length over extended couplers	60.7, 80.5 or 85.4 ft
- Vehicle width	100 inch
- Vehicle width over doors threshold	100 inch
- Vehicle height maximum	126 inch
- Maximum weight per vehicle (empty)	37040-49200 lb

Remark: This depends on the length of the Phileas vehicle

- Ergonomic design	YES

2. Performance:

- Maximum operation speed	55 mph
- Maximum acceleration rate	2.9 mphps
Remark: This acceleration is adjustable.	
- Service brake rate	2.9 mphps
Remark: Can be adjusted	
- Emergency brake rate	>11.2 mphps
Remark: According regulation for buses in EU	
- Minimum horizontal radius curve	41 ft
- Minimum vertical radius curve	172 ft
- Maximum grade	unknown
- Maximum sustained grade	13%
Remark: Continuous speed for Phileas 85.4 ft and fully loaded	

3. Passenger accommodation:

The passenger accommodation can be completely changed according the wishes of the customer, because the vehicle has 100% low floor.

- Wheelchair places	1 or 2
- Number of seats	Variable
Remark: To be defined in discussion with customer	
- Number of standees	Variable
Remark: To be defined in discussion with customer.	
- Total number of passengers	210

Remark:

Max passenger load for 85.4 ft vehicle is 30.200 lb (Total load 79.400 lb)

- Air conditioned	YES
- PA system with auto-announcer	Local supplier
- Passenger to OCC communications	Local supplier
- Destination and passenger information display	YES

4. Train Sets:

- Capable of coupling — Not Applicable

  Remark: Electronic coupling (platooning) will be developed in 2010

- Capable of failed train (Phileas) retrieval — YES

  Remark: Vehicle can always drive unguided and has also the possibility for driving in a limp-home mode

- Capable of bi-directional operation from each car — Not Applicable

System characteristics questionnaire

1. Superelevation Limits: Not Applicable

- Phileas is virtual rail system with magnet guidance

2. Route Geometric Constraints:

- Our Phileas vehicle meets the following criteria:

- Minimum horizontal radii

    - Maintenance facility: 150 ft; The Phileas has a horizontal radius of 40 ft and the possibility to move the vehicle parallel with a joy stick which is delivered with the vehicle.

- Minimum horizontal lengths

    - Phileas fulfils the requirements

- Vertical alignment

    - Phileas fulfils the requirements; maximum grade at stop 3%

3. Hours of Operation: YES

4. Station Dimensions: YES

- Platform length depends on the number of vehicles, which have to stop at one platform. Per vehicle 100 ft is needed.

5. Emergency Evacuation Walkways: YES

- The construction of the infrastructure shall be developed with a local Hawaiian construction company. In the development of the fixed guide-way construction we shall use the requirements mentioned in this document

6. Traction Power:

- Voltage (as trolley)	750 Volt
- Substation spacing	450 ft
- Substation size	Not Applicable

- If Honolulu should decide that the version of the Phileas has to be a trolley, then the electrical installation has to be provided by a local supplier. The size of the electrical station will be decided by Vossloh-Kiepe, who is the supplier of the traction installation.

7. Train control/Signal system:

Bi-directional fully automatic train operation	YES/NO

Remark: Our concept can drive fully automated but not bi-directional

8. Communications:

- Radio system	Local supplier
- Passenger communication system to OCC/Operators:	
On-board Closed Circuit Television	Local supplier
Fire & Emergency management system	Local supplier
On-board ADA message system	Local supplier

9. Noise and vibrations:

- Meet or exceed levels of FTA and the goal of 75 dBA at stations	YES

- Remark: 75 dBA is met at the stations. Levels of the FTA have to be checked.

- Noise level at 55 mph at 50 feet (asphalt) < 80 dBA
  - Location, where this can be measured is the Test Track of DAF Truck in St. Oedenrode, The Netherlands.

10. Other characteristics:

- ADA requirements will be met when vehicle will be introduced in the US
- The "Buy America Act" will be met at the delivery of vehicles. We have two possibilities, a co-operation with an US supplier or to start up our own facility with some local investors.
- It is very cost effective (cheap) to operate and maintain, because it is also based on bus technology.
- Maintenance facility is the same as a bus maintenance facility; maybe even existing locations can be used.

26m (85 feet) Phileas vehicle for Istanbul (Turkey)

Bombardier

BOMBARDIER

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fax 650-821-7371

January 22, 2008

City & County of Honolulu
Division of Purchasing
Department of Budget and Fiscal Services
520 South King Street, Room 115
City Hall
Honolulu, Hawaii 96813

Subject: Response to Request for Information (RFI 001)
Information Package, System Characteristics Questionnaire
Notice to Fixed Guideway System Vehicle Suppliers

Attention: Ms. Mary Patricia Waterhouse, Director

Dear Ms. Waterhouse:

Thank you very much for providing Bombardier with the opportunity to respond to RFI 001, Request for Information in connection with the Honolulu High-Capacity Transit Corridor Project's Locally Preferred Alternative.

Bombardier is very pleased to support this RFI by providing detailed information regarding our technologies, experience and capabilities, as well as our input on the First Project System Characteristics that were presented in the RFI. We believe it is essential for the City to hear the views of technology suppliers and to benefit from the worldwide experience and best practices that have been undertaken on similar transit projects. Bombardier's experience spans the globe and we are pleased to share the detailed information that we have presented to you in the enclosed response.

We have also followed your advice to enclose additional promotional information including images, a DVD and drawings. Because any technology chosen as the backbone for a major city must also be backed by an experienced, capable and strong supplier, we have also enclosed our latest Annual Report.

Please do not hesitate to contact the undersigned at (650) 821-7363 or andy.robbins@us.transport.bombardier.com, should additional information be required.

Sincerely,

Lynne Maloney for Andrew Robbins

Andrew S. Robbins, P.E.
Senior Director, Project Development
Bombardier Transportation

BOMBARDIER

Respondent Contact Information:

Company:	Bombardier Transportation (Holdings) USA Inc.
Address:	1501 Lebanon Church Road Pittsburgh, PA 15236
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BOMBARDIER

Bombardier Comments on "First Project System Characteristics"

The ART technology described in this Information Package was developed as a total system solution for medium capacity transit applications, as has been described more fully in this submittal. Therefore Bombardier Transportation offers the ART solution only as a full systems solution. Therefore it is highly recommended that the City and County of Honolulu procure the operating system, often referred to as the "Electrical and Mechanical (E&M) system" under one contract. The operating system would include at a minimum, the vehicles, signaling, power supply, communications, maintenance tools and equipment and platform screen doors (if used.) Systems integration engineering would also be the responsibility of the E&M supplier, a major advantage to the owner as the E&M supplier then assumes the risk of assuring that all of the systems equipment is compatible and functions together. Bombardier would not be in a position to offer only ART vehicles for the initial system delivery under a "rolling stock" only contract.

Bombardier offers the following comments on the "First Project System Characteristics" shown on Pages 3 through 7 of the RFI information package:

<u>Item 7 – Route Geometric Constraints</u>:

It is highly suggested that the system design criteria not be constrained to the minimum horizontal radii shown, but instead to allow lower values. As described more fully in the detailed responses to the questionnaire, the ART technology being offered by Bombardier is capable of 115 feet horizontal radii in the maintenance area and 230 foot horizontal radii on the elevated structure. In special trackwork areas, the horizontal radii can be further reduced to 87 feet. These lower values will offer cost savings and increased flexibility on facility and guideway design.

It is also suggested that while a maximum vertical line grade of 6% be a design criteria for ride comfort purposes, in special circumstances a vertical line grade of 8% be permitted. This increased value will again offer increased flexibility in the design of the guideway and facilities.

<u>Item 10 – Line Capacity</u>:

It is highly suggested that the maximum line capacity for future expansion purposes be at least 15,000 pphpd. Any technology chosen should have the capability to meet this line capacity in future expansion.

<u>Item 13 – Station Dimensions</u>:

It is highly suggested that the maximum platform length to be considered be 240 foot. This will improve urban fit.

It is also highly recommended that the design criteria for the initial system include the provision of platform screen doors in all stations. Virtually all new transit systems worldwide are now including platform screen doors and many older systems are retrofitting platform screen doors into their stations. Platform screen doors offer unsurpassed safety, reduced liability insurance, increased system availability, reduced maintenance costs and of course virtually eliminates the human tragedy and disruption of human intrusion onto the guideway. Platform screen doors also offer a superior environment on the station platform for passengers, with reduced noise and dust and protection from rain and wind.

Without platform screen doors, the ability of operations and maintenance providers to offer guarantees of high system availability will be diminished.

<u>Item 18 – Fare Collection</u>:

It is suggested that fare gates be strongly considered in lieu of a self-service honor system. A barrier system greatly reduces fare evasion and also provides a stronger sense of security for passengers. Some honor systems on existing transit systems are now being replaced by a fare gate system because studies have shown that the costs associated with fare evasion and less control of security outweigh the costs of providing, operating and maintaining a fare gate system.

Honolulu RFI Introduction

Technology Selection for Honolulu

A range of proven technologies could satisfy the technical requirements of the Honolulu High-Capacity Transit Corridor Project. Bombardier Transportation has the broadest portfolio of such transit system technologies in the industry, including:

- The *BOMBARDIER FLEXITY** family of light rail vehicles
- The *BOMBARDIER MOVIA** family of metro vehicles
- The *BOMBARDIER INNOVIA** and *CX-100** family of automated people-movers
- The *BOMBARDIER* Monorail
- *BOMBARDIER* 's Advanced Rapid Transit (ART) (a class of driverless rapid rail)

* *BOMBARDIER, FLEXITY, MOVIA, INNOVIA* and *CX-100 are trademarks of Bombardier Inc. and its subsidiaries.*

Bombardier's unmatched experience in the turnkey supply of urban transit systems includes systems employing all of these technologies. This experience includes contracts ranging from vehicle supply only, to contracts for the turnkey design, supply, operation and maintenance of complete automated driverless transit systems.

Operations and maintenance (O&M) services are provided by more than seven thousand Bombardier employees at more than ninety locations around the world. These services range from full O&M to maintenance only to advisory services, for automated transit systems, automated people-movers, commuter rail systems and light rail systems. The experience gained from operating and maintaining these systems, including concessions in which Bombardier is an equity participant, ensures that Bombardier personnel have an excellent understanding of system operation and maintenance costs. This experience and understanding of operations and maintenance issues is also exploited in the design of the transit systems that Bombardier builds, ensuring that they are designed for flexibility of operation and ease of maintenance.

When Bombardier submits a bid for a design, build, operate, maintain (DBOM), build-operate-transfer (BOT) or concession transit system contract, the specification is sometimes a performance specification only, with the choice of technology left to the concessionaire. In such cases, systems engineers and financial analysts in Bombardier's Total Transit Systems division use all of the data and experience derived from its turnkey transit system supply contracts and O&M contracts to determine the most cost-effective technology for the application from a total life-cycle cost point of view. This often involves selecting from among two or more of the technologies listed above.

In recent years when this analysis has been performed for urban transit applications with requirements similar to those of the Honolulu High-Capacity Transit Corridor Project, including the expected high ridership for the Kapolei to Manoa line, the most cost-effective solution has been Bombardier's Advanced Rapid Transit technology. Based on our preliminary analysis of the project requirements, we believe that ART will be the most cost-effective technology for this project as well. In addition, it will offer the best system performance.

ART technology is advanced, and it is proven in service. ART has clear advantages: superior performance; environmental friendliness; excellent urban fit; unmatched cost-effectiveness and exemplary safety. These advantages are further explained below.

Figure 1 Vancouver SkyTrain Millennium Line

Advanced, Proven

Unlike some conventional urban rail transit systems that have been assembled using a poorly integrated collection of pre-existing fifty-year-old (or more) technology, ART technology was designed in the modern era starting from a clean sheet of paper. There were no design limitations imposed by previously existing legacy designs or equipment. Proven systems engineering principles adopted from the aerospace

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industry were rigorously employed in the development of the ART system, which took place in the mid-1970's and early 1980's. The technology choices that were made, which included linear-induction motor (LIM) propulsion, radial steering bogies, lightweight vehicles and full driverless automation were ground-breaking and revolutionary at the time, but have been widely copied in the subsequent two decades.

ART technology delivered superior performance from its inception as implemented in Scarborough (a Toronto suburb, in service1985), Vancouver SkyTrain Expo Line (1986), Detroit (1987), Kuala Lumpur (1998), Vancouver SkyTrain Millennium Line (2002) and JFK Airport (2003). Systems are presently under construction in Yongin, Korea and Beijing, China. As shown in Figure 2 below, Bombardier's experience with this type of technology far exceeds that of its nearest competitors.

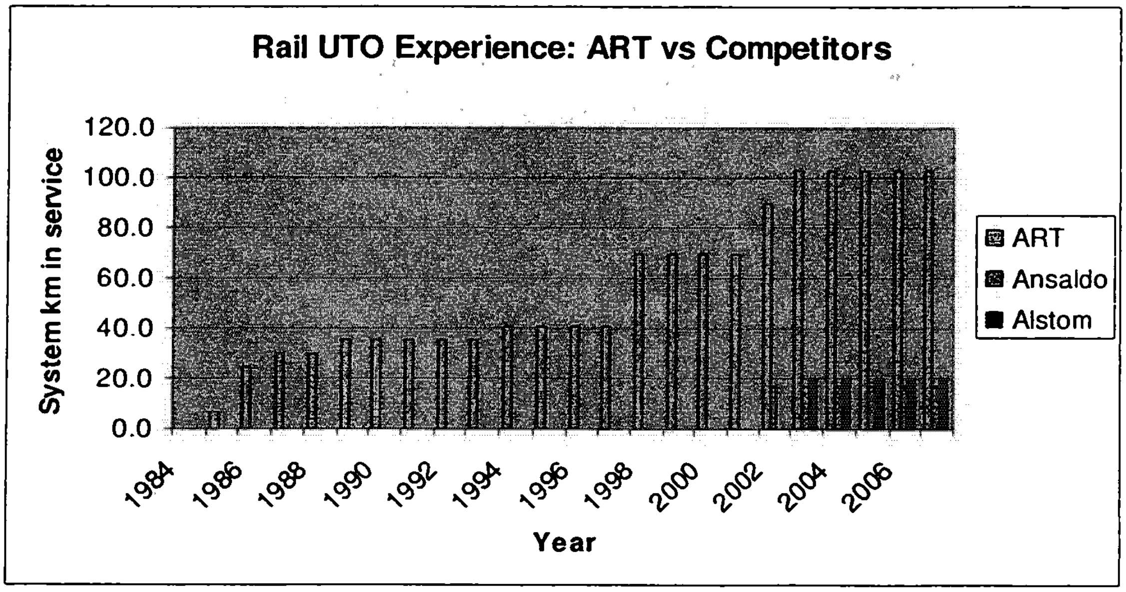

Figure 2 Rail Unattended Train Operation Experience

In more than twenty years of operation, ART technology has proven to offer consistently excellent, reliable and very cost-effective service. The cost of operation, in terms of dollars per passenger (or any other meaningful measurement) is the lowest of any comparable system, as demonstrated by Federal Transit Administration data (shown in Figure 15 on page 15).

Superior Performance

The linear-induction motor (LIM) propulsion system of ART technology is an advanced, direct drive magnetic propulsion system that does not rely on traction or adhesion between wheels and rails. ART is in fact a *magnetically propelled train.* The LIM is also used for regenerative braking, with the result that ART is free from

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the issues of slip/slide that plague conventional rail technology in slippery rail conditions. Such conditions occur frequently, especially at the onset of rain. Under such conditions a thin, slippery film of iron oxide paste forms at the surface of the rail, inhibiting effective wheel/rail contact.

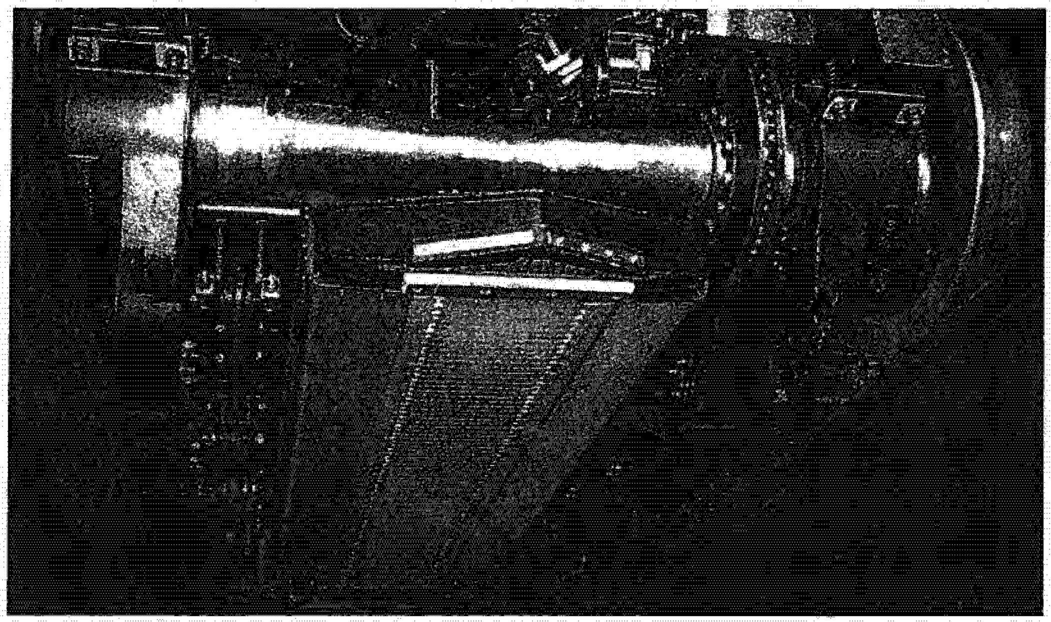

Figure 3 The Linear Induction Motor Primary

Freedom from slip/slide issues allows ART technology to deliver high performance consistently, like clockwork, regardless of weather or rail conditions. Such capability is critical for automated, unattended driverless systems, especially where short trains operate at short headways to minimize passenger waiting times. A train that slides past the platform stopping point would be very disruptive in such an operation.

Freedom from slip/slide issues also allows ART technology to use higher acceleration and braking rates under all weather conditions, minimizing travel time. The passenger sees benefits in three ways: clockwork dependability, shorter wait times, and shorter travel times. This is the kind of service that attracts riders.

Note: Some suppliers of conventional rotary-propulsion rail transit systems claim that wheel-rail adhesion issues are adequately handled by slip/slide controls. What they fail to mention is that the only method by which slip/slide can be prevented using such controls is through much reduced acceleration and braking rates, and/or unplanned, extended stopping distances. There is a large penalty in system performance associated with such controls.

Environmental Friendliness, Urban Fit

As stated above, ART technology was designed from a clean sheet of paper using a systems engineering approach. This process started with an operational requirements document, which stated the objectives of the system design. One of the primary objectives was the ability to fit within a modern urban streetscape using elevated guideway. Elevated guideway was chosen because tunnels are too expensive for the intermediate capacity systems (8,000 to 30,000 persons per hour per direction) required by most medium-sized cities, and street-running systems cannot deliver this range of system capacity.

To be acceptable in a modern urban environment, especially one with the beautiful natural setting of Honolulu, an elevated transit system must have a slim, elegant, unobtrusive guideway, unobtrusive and elegant stations, and very low noise levels.

Figure 4 The Vancouver SkyTrain Expo Line

ART technology achieves these objectives in the following ways:

The Radial Steering Bogie

ART's patented radial steering bogie offers very low-noise operation, even in small radius curves. It achieves this low-noise operation by steering the axles so that they are aligned with the radius of the curve.

The wheel flanges do not normally contact the rail even in small-radius curves, eliminating a common source of noise. Other manufacturers claim to have steerable bogies, but these bogies have a very limited range of motion that cannot match the radial steering performance of the ART bogie (see Figure 5).

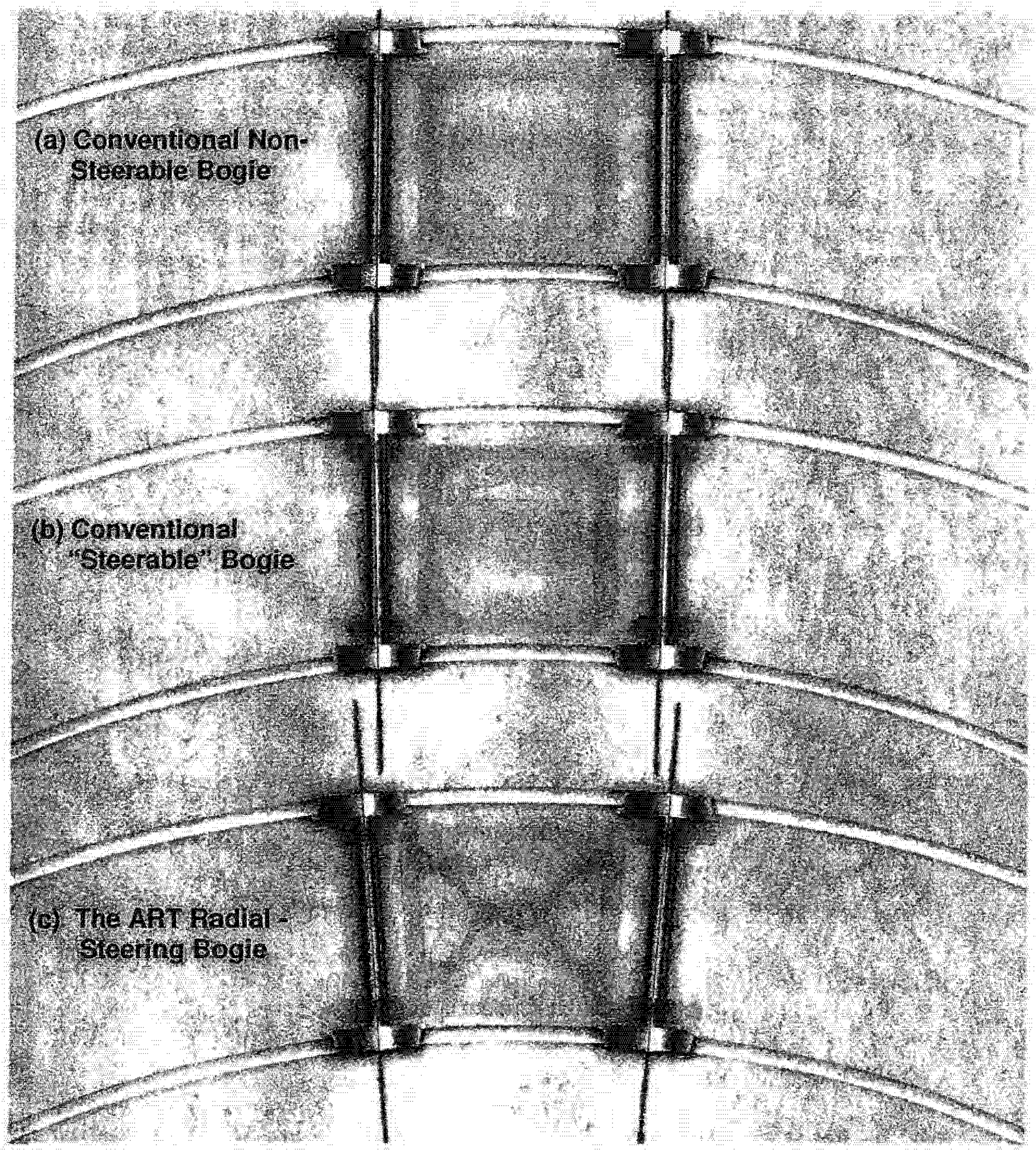

Figure 5 The ART Radial Steering Bogie compared with Conventional Bogies

Steep Grade Capability

The direct-drive LIM propulsion system of the ART *magnetically propelled train* is capable of providing consistent, reliable, all-weather operation on steep grades of 8 to 10% (the maximum depends on factors such as the specified train recovery scenarios). Conventional rotary propulsion is limited to grades of about 3.5%. This superior grade capability of LIM-propelled trains is recognized in the rail regulations in Japan (Article 18 of the Ministerial Ordinance for Railway Technical Standards, Grades).

The steep grade capability of the ART *magnetically propelled train,* in combination with the low-noise small-radius curve capability described above, provides the planners and designers of the transit system alignment with much more flexibility than they would have with conventional light rail technology. This allows the system designers to create elegant alignment designs that route the guideway through streetscapes that would have to be bulldozed to accommodate less flexible technologies.

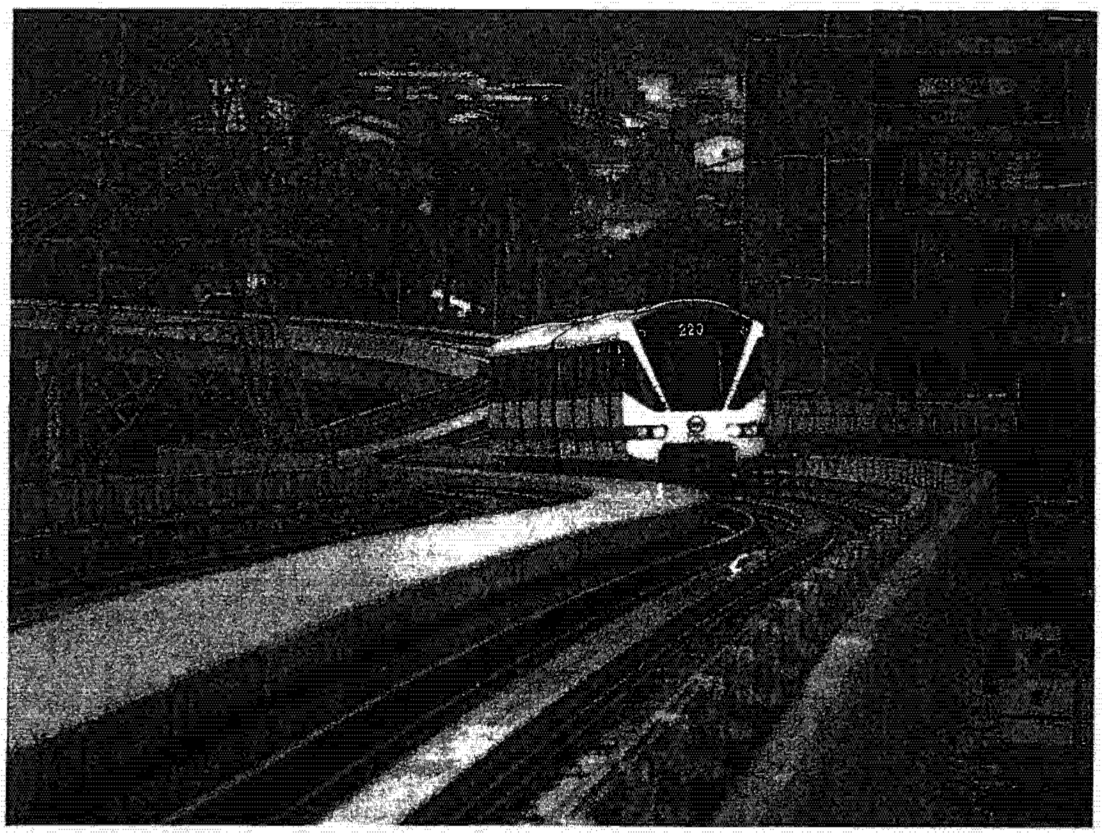

Figure 6 ART Technology in Kuala Lumpur – The Kelana Jaya Line

Note: Suppliers of conventional light rail vehicles will claim that their products can negotiate small-radius curves and operate on steep grades. What they cannot claim is to achieve very low noise levels in the small-radius curves without wheel or rail lubrication, nor can they claim to achieve safe, consistent and reliable operation of short unattended trains at short headways on steep grades under all weather conditions. Such performance requires a means of propulsion and braking that is independent of wheel-rail adhesion.

The wheel/rail lubrication required for conventional light rail vehicles to operate with acceptable levels of noise and rail wear in small radius curves will also compromise wheel/rail adhesion and hence their performance on steep grades. Even when lubrication is not present, suppliers of conventional rotary propulsion technology cannot guarantee safe, consistent and reliable operation of short unattended trains at short headways on steep grades under all weather conditions.

Figure 7 ART Technology in Kuala Lumpur – The Kelana Jaya Line

Lightweight Vehicles

In addition to facilitating the design of the radial-steering bogie, the linear induction motor allows the use of smaller disk brakes, smaller diameter wheels and other features that result in a strong but lightweight bogie. Gearboxes, bearings and drive shafts are eliminated, further reducing the vehicle mass. These features, together with a lightweight welded aluminum vehicle structure, result in a significantly less massive vehicle than comparable conventional rail vehicles.

The lower mass of the ART vehicle allows the use of slender, less obtrusive guideway structures with wider column spacings, reducing the visual impact on the cityscape. Lower vehicle mass also helps to reduce energy consumption.

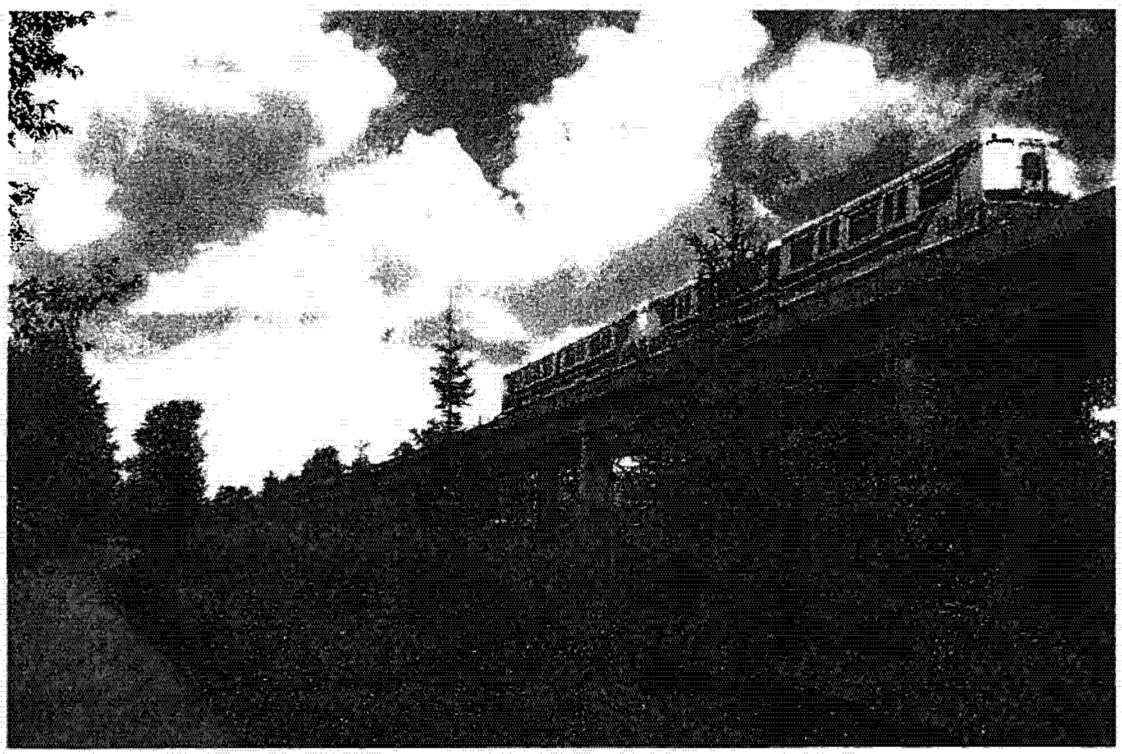

Figure 8 The Vancouver SkyTrain Expo Line

Operation of Short Trains at Short Headways

A given system capacity (e.g. the 9,000 persons per hour per direction requirement stated in the RFI) can equally be achieved by operating two-car trains at approximately two-minute intervals (headway), or six-car trains at six-minute headways. The total vehicle fleet is the same in either case. Conventional thinking in the past dictated using longer trains at longer intervals, primarily to reduce the number of drivers required. The fact that this meant longer waiting times and more inconvenience for passengers was considered unfortunate but acceptable.

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The operational requirement on which the design of ART technology was based adopted the opposite view: operation of short trains at short headways would reduce passenger waiting times, providing a more attractive service while allowing a given system capacity to be achieved using shorter station platforms, which reduces the cost and visual obtrusiveness of the stations. All contribute to a win-win scenario.

ART was designed from the beginning to be capable of fully automated, driverless and unattended operation, so there was no staffing penalty associated with the operation of more (shorter) trains to achieve a given system capacity. There were technical challenges associated with unattended operation of short trains at short headways, but these were solved in the ART development program in the early 1980's, with the result that the system implementations have been consistently smooth and free from performance problems. Competitors offering conventional rotary-propulsion vehicles cannot make this claim.

Figure 9 The AirTrain JFK Control Room

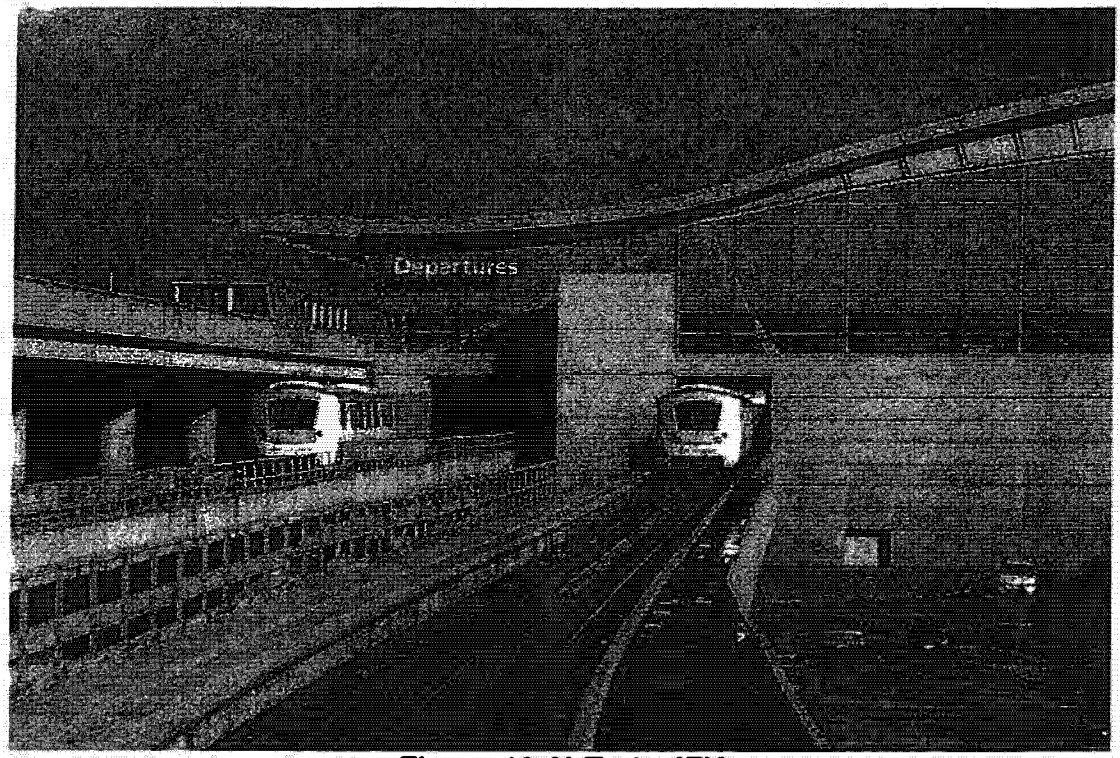

Figure 10 AirTrain JFK

Cost Effectiveness

The ART *magnetically propelled train* achieves outstanding system cost-effectiveness in several ways:

Capital Costs

ART reduces the capital cost of passenger stations because it achieves the same system capacity as less capable technologies by employing shorter trains operating at shorter headways. This allows the use of shorter stations with shorter platforms and correspondingly fewer platform doors, less lighting, smaller air conditioning units, etc.

Guideway costs are also reduced because of the smaller loads imposed by the shorter, lightweight ART trains. The cost of utility relocation, which can be a very significant portion of system cost, especially for street-running systems, can be reduced by the use of fewer columns and longer guideway spans. The steep grade capability of ART technology allows the guideway to follow the terrain more closely in hilly areas, reducing average guideway column height, which, in turn, reduces costs.

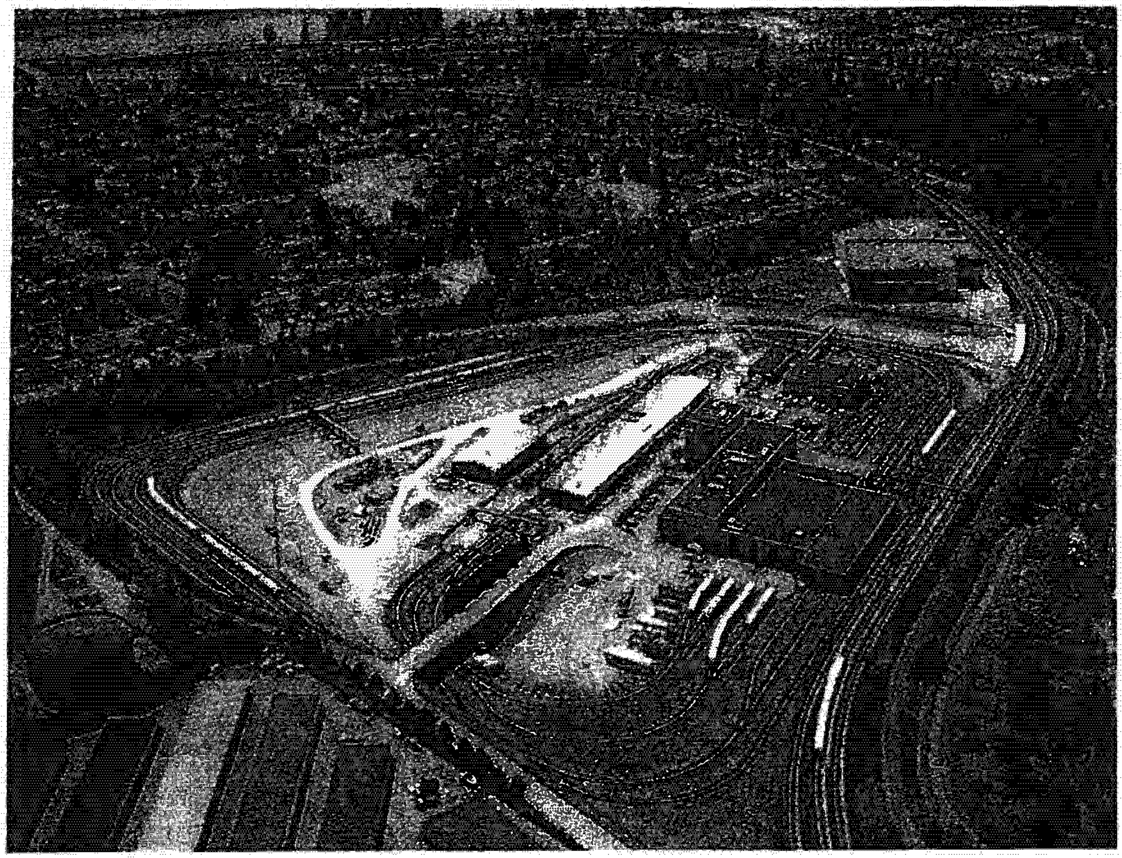

Figure 11 The Vancouver SkyTrain Operations, Maintenance and Storage Facility

The small-radius curve capability of ART allows Bombardier's system designers to fit the system maintenance facility and storage lanes into significantly smaller areas than conventional technology would require, saving real estate costs in urban areas where these costs can be large. Figure 11 shows the Vancouver maintenance facility, which serves a system with over 30 miles of dual-track guideway and a fleet of 210 vehicles (increasing to 244 under an existing contract for additional fleet).

Operations and Maintenance Costs

ART technology achieves very significant operations and maintenance cost savings in the following ways:

- by eliminating the need for train drivers and train attendants
- through the use of fully automated storage yards, eliminating the need for train hostlers
- by incorporating a very high level of self-diagnostic and monitoring equipment in the vehicles, facilitating maintenance

- through the use of a low-mass vehicle design, which results in reduced energy costs
- through the use of full driverless automation, which reduces energy consumption because it allows consistent, optimized, smooth vehicle velocity profiles (i.e. avoiding jerky driving - sudden acceleration followed by sudden braking)
- through the use of a LIM propulsion system and vehicle bogies that are mechanically simple, with fewer moving parts requiring maintenance
- through the use of LIM regenerative braking rather than friction brakes for most service braking, reducing brake wear and disk brake system maintenance
- by using a radial steering bogie, which results in greatly reduced wheel wear and rail wear (and noise)
- by incorporating the lessons learned from Bombardier's experience in operating and maintaining existing urban transit systems into the design of new systems, to ensure that they are designed for flexibility of operation and ease of maintenance

The proof is in the results, which are published by operators such as BCRTC (Vancouver SkyTrain), and the Federal Transit Administration (FTA).

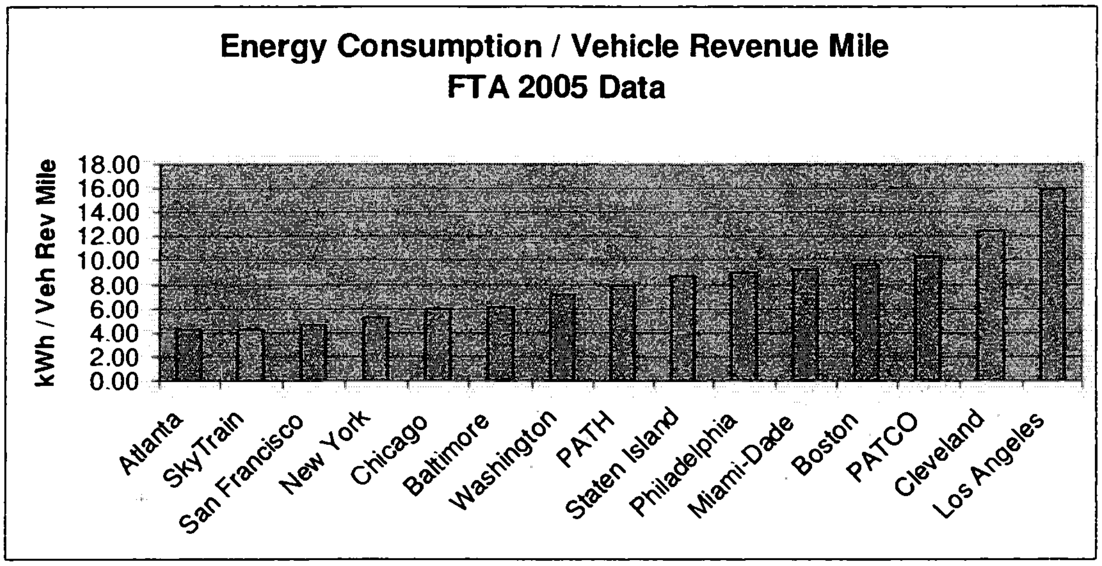

Figure 12 Energy Consumption / Vehicle Revenue Mile – FTA 2005 Data

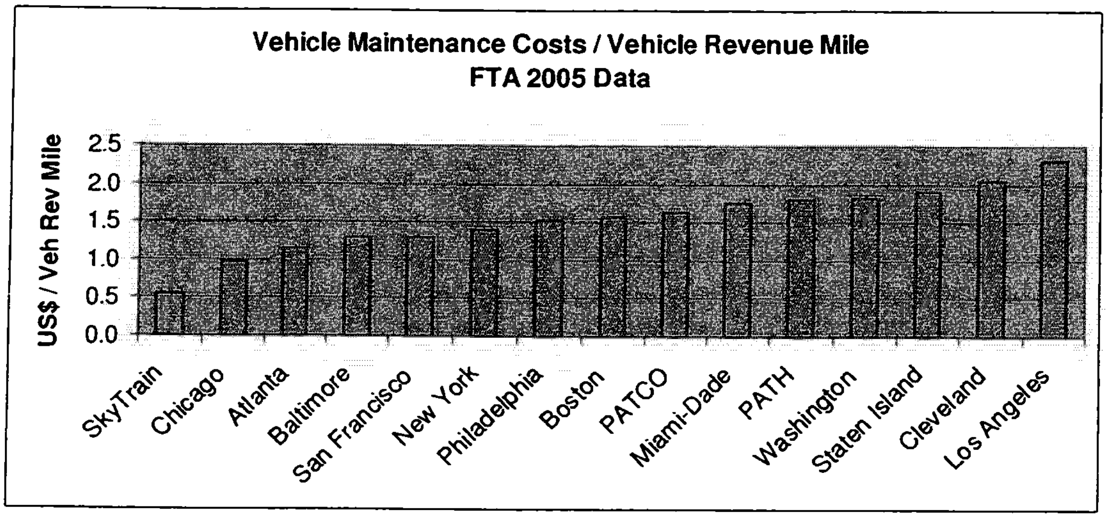

Figure 13 Maintenance Costs / Vehicle Revenue Mile – FTA 2005 Data

The 'bottom line' is the total O&M cost per passenger. Figure 15 shows actual total O&M cost data as collected by the Federal Transit Administration for U.S. transit systems, compared with actual O&M cost data for two systems using ART technology; AirTrain JFK and the Vancouver SkyTrain system. When comparing systems that carry similar numbers of passengers per year, the blue curve, identifying ART technology, shows approximately half the cost per passenger as the black curve, which shows the trend for the FTA data.

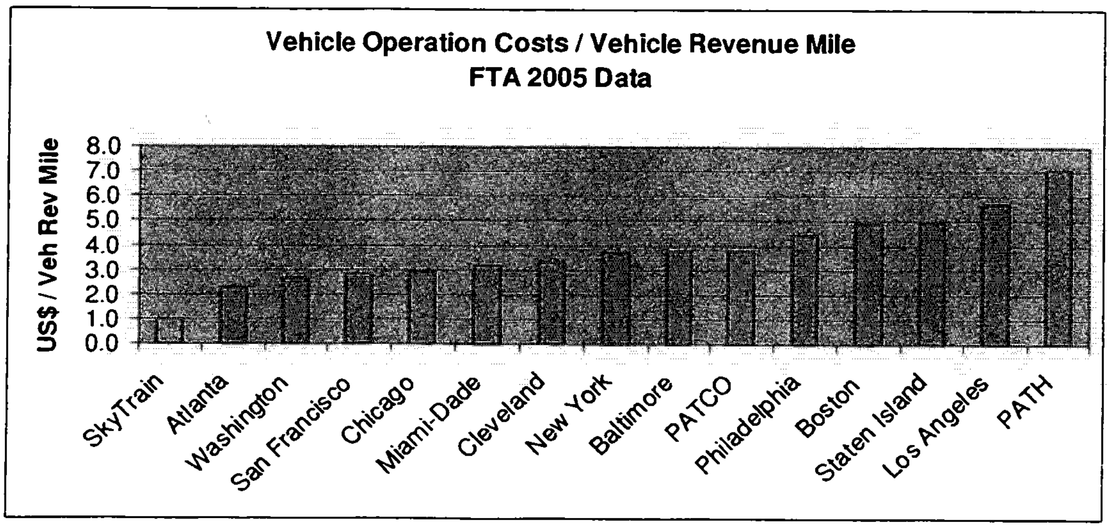

Figure 14 Operation Costs/Vehicle Revenue Mile – FTA 2005 data

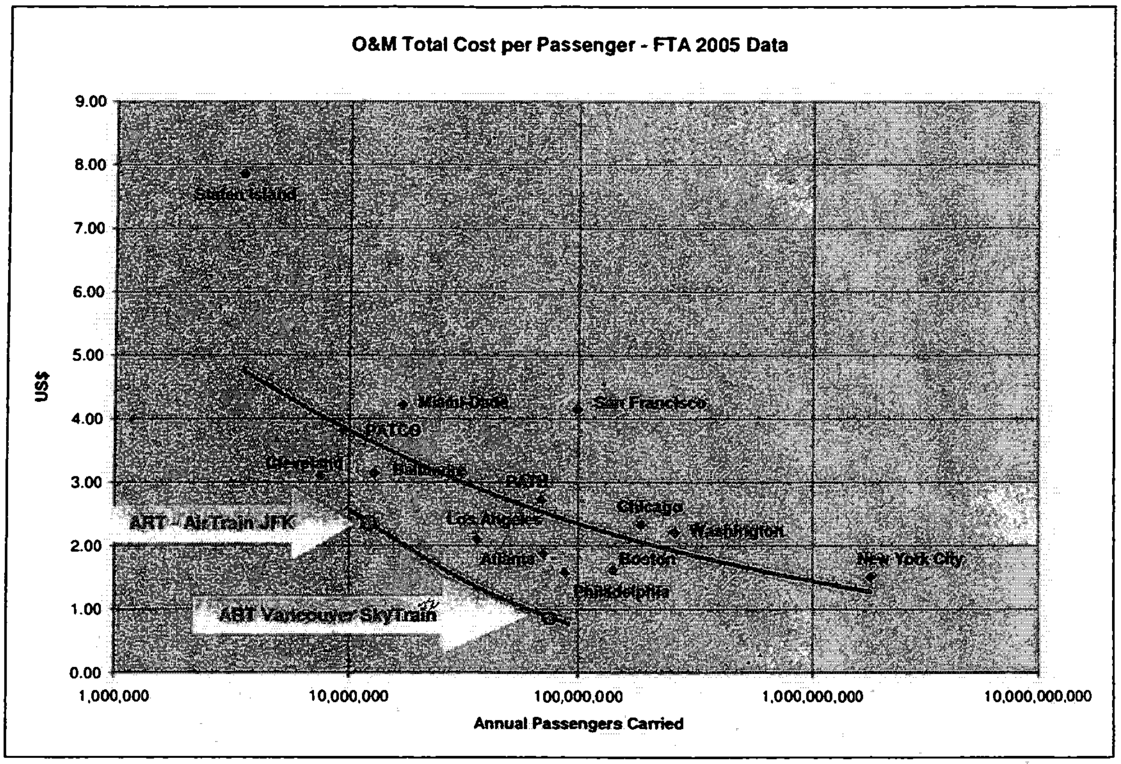

Figure 15 O&M Total Cost per Passenger – FTA 2005 Data

In both cases the cost per passenger is lower for systems carrying more people, as would be expected from economies of scale, but note that the per-passenger cost for the Vancouver SkyTrain is significantly lower than all of the other systems, even that of the New York City Transit Authority, which carries more than ten times as many passengers per year.

Figure 16 Vancouver Millennium Line

Safety

The safety record of ART technology is exemplary, much better than transit systems with drivers, and far better than streetcar or light rail systems that operate in the streets, where there are inevitably collisions with motor vehicles and pedestrians.

The following ART design features enhance system safety:

Driverless Operation – The vast majority of rail accidents are caused by driver error, thus driverless operation offers a significant improvement in system safety.

Segregated Guideway – A fully automated driverless system must operate on a segregated guideway equipped with guideway intrusion detection. This is a huge benefit because it prevents people from wandering in front of trains.

Fully Automated Depot – ART systems feature fully automated train launching and train storage in depot storage lanes, eliminating the need for train drivers or hostlers to walk into the depot storage lanes.

Platform Screen Doors – Automatic platform screen doors are supplied for virtually all new systems, such as AirTrain JFK. Such doors prevent most suicides and accidental intrusion into the trackway in platform areas.

Conservative System Design – ART systems are rigorously designed as fully automated, driverless systems with very careful analysis of safe stopping distance under all reasonable conditions of equipment failure, weather, grades, wheel-rail adhesion and similar criteria. Evidence of these rigorous design principles was an essential element of the process of introducing this technology 23 years ago and remains so today.

Other Technologies

As stated at the beginning of this introduction, Bombardier is capable of supplying a range of technologies that could meet the basic requirements of the Honolulu High-Capacity Transit Corridor Project. Our recommendation of ART technology is based on a preliminary system analysis, which indicates that ART will offer the best combination of superior system performance, system aesthetics, and system life-cycle costs, while attracting more ridership than other potential solutions. A more complete analysis will be performed when all of the system requirements are specified in detail, but we are confident that unless some basic aspect of the specified requirements is changed, the conclusion will be the same.

As stated above, full driverless automation is an essential element in achieving safe, cost-effective operation of short trains at short headways. Short-train/short-headway operation is in turn a fundamental aspect of a successful intermediate-capacity urban transit system. This is because such operation allows the system to provide frequent service even in off-peak hours, economically, while minimizing passenger wait times and maximizing ridership. The economic and aesthetic benefits related to shorter stations have also been stated above.

Bombardier could offer a solution from our *FLEXITY* range of light rail vehicles or our Movia metro vehicles for this application, but these technologies have been optimized for somewhat different operating scenarios, and do not provide the most cost-effective solution for a fully automated system in the intermediate capacity range that is required for Honolulu. (We note that the system is called the Honolulu *High-Capacity* Transit Corridor Project, but we are suggesting that it is an intermediate-capacity system when compared with underground metros, some of which have capacities of 50,000 pphpd or more).

Rubber-tired technologies such as Bombardier's *INNOVIA* automated people-mover can provide many of the features and capabilities described above as desirable for this project, but the optimum range of application for these technologies tends to be in the lower speed range.

Monorail technology, another offering available from Bombardier, is applied to specific projects that can benefit from the visual appeal that monorail offers. However this technology does not offer nearly the same advantages for higher capacity applications as compared to ART, and therefore Bombardier has ruled out its application for the Honolulu application.

Because of its proven performance, environmental friendliness, proven lowest-in-class O&M costs, superior urban fit and system aesthetics, and exemplary safety record, we believe that ART technology and its *magnetically propelled trains* will be the best solution for Honolulu.

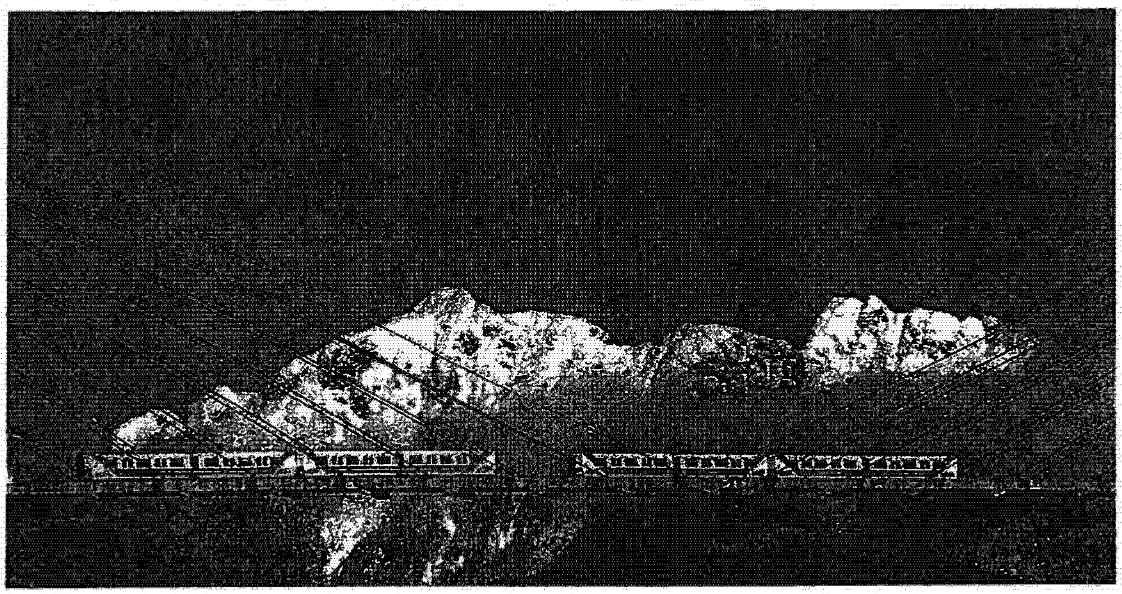

Figure 17 Vancouver SkyBridge

AirTrain JFK is a trademark of the Port Authority of New York and New Jersey. SkyTrain is a trademark of BC Transit.

INFORMATION PACKAGE
SYSTEM CHARACTERISTICS QUESTIONNAIRE
NOTICE TO FIXED GUIDEWAY SYSTEM VEHICLE SUPPLIERS
REQUEST FOR INFORMATION
(RFI 001)

Bombardier Transportation

Technology Characteristics Questionnaire

<table>
<tr><td></td><td>I – FUNCTIONALITY</td></tr>
<tr><td>1.</td><td>Please provide a brief product description of your system, including any special guideway general arrangements, cross sections and technical details.</td></tr>
<tr><td></td><td>The Advanced Rapid Transit System (ART) is a fixed guideway transit system that operates on segregated guideways, at grade, elevated or underground. Key subsystems include:

Communication-based, moving block automatic train control system
Power supply and distribution system (including supervisory control and data system and blue light stations)
Communications onboard and in stations (including radio, passenger information systems), public address, fiber-optic communication backbone
Trackwork, including all turnouts and crossovers
Automatic fare collection system
Platform edge safety systems and station amenities
Depot which includes the control center, storage and maintenance facilities including automatic car wash and wheel truing
The fleet consists of vehicles configured as 1, 2 or 4 car trains. Various functional features are provided, depending on the application. Each vehicle is supported by two trucks, each with two axles and steel wheels and the unique radially steering axles. Propulsion is provided by one linear motor primary on each truck, a “direct drive” propulsion system. For service braking, the LIM motors are supplemented by disc brakes on the axles, and in emergency braking by two electro-magnetic track brakes per truck. Ingress and egress is facilitated by three wide doors on each side. Key subsystems on vehicles are redundant to maximize service availability.

ART is designed to reduce capital and operating costs of a medium capacity system by enabling urban fit, the use of elevated guideway, and automatic unattended operation with short trains at short service intervals. The system line capacity brackets that identified for the Honolulu fixed guideway system. With linear motor propulsion it delivers reliable service in all weather conditions. Automated unattended operation also provides operational flexibility to respond to special events, unplanned events and to offer attractive</td></tr>
</table>

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	service in off-peak hours. This technology has demonstrated reliable automatic unattended operation for over 20 years, an achievement that no other steel wheel and steel rail system can match. Refer to Attachments A and B
2.	Are there any limitations with your system providing the required level of service along the First Project's 20 mile route selected and station spacing adopted? If so, please explain.
	No. A system based on ART technology will fully meet the requirements and objectives (as identified in the alternatives analysis document) of the First Project's 20 mile route. The requirements are very similar to those for previous applications such as Vancouver.
3.	Can your system carry a maximum of 9,000 pphpd during the peak periods? Please provide the number of vehicles per train, number of trains and headways for each case. Also identify the square feet per seated and standing passenger assumed.

Information Marked Proprietary

Information not supplied

	Response is CONFIDENTIAL and PROPRIETARY
4.	Can your system deliver an average end-to-end travel time of 40 minutes for the First Project with a 20 second dwell time at each station?
	Yes. For the system envisioned, with 1 mile station spacing, an end to end travel time of 40 minutes is a reasonable objective. Once the horizontal and vertical alignment details are available, including number and radii of horizontal curves, a simulation will confirm the performance.
5.	Can your system accommodate guideway switching and crossing over with 2 minute main line headways? If your system is other than a conventional rail technology, please provide details of the guideway switching apparatus (from an existing operating system) for both turnouts and crossovers, including general arrangement drawings, mechanism details and costs along with times to change routes.
	Yes. ART uses conventional steel wheel steel rail technology for switches and turnouts, not moving beam technology. Local main line headways of less than one minute are practical. ART uses off-the-shelf movable frogs to reduce noise and vibration and to reduce rail and vehicle maintenance.

[redacted]

7.	Can your system support future expansions and extensions?
	Yes. Bombardier normally designs for the ultimate system and examines future potential expansions and extensions to ensure that the system installed would enable a smooth transition. For example, Vancouver has successfully extended its system to over 32 miles in several extensions, one of which included transition to a new control centre with no loss of regular service. Kuala Lumpur has recently contracted for more than a doubling of fleet and is exploring a significant system extension. Recently, the Port Authority has considered additional cars to increase service levels and is planning for a train and wayside upgrade that would enable operation of 4-car trains.
8.	Can other manufacturers provide interoperable vehicles in a future procurement? If so, please provide the names of up to four other manufacturers of compatible equipment.
	ART is based on steel wheel steel rail technology at standard gauge and any number of manufacturers could potentially supply vehicles that may be inter-operable. Inter-operability, however, involves interfaces with other subsystems such as power supply/power pickup, train control and communications. The ART-based AirTrain system at JFK Airport was designed to accommodate a future "one seat ride" vehicle compatible with Long Island Rail Road. Suppliers of steel wheel steel wheel vehicles include: Siemens, Rotem, CAF, Ansaldo Breda Alsthom and others. The recent 140 car upgrade for Kuala Lumpur was won by Bombardier in open competition with Kawasaki and RotemIn this case both offer linear motor powered vehicles.
9.	Can multiple manufacturers provide compatible interfacing systems equipment in a future procurement? If so, please provide the names of up to four other manufacturers of compatible train control/signaling, traction power distribution, propulsion and braking control equipment.
	• Train control - moving block automatic train control systems regardless

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	of supplier are proprietary and not compatible with each other • Traction power and distribution - in general, suppliers can be identified that will supply similar equipment, with the similar functionality • Vehicle propulsion- suppliers can be identified that will supply similar equipment, with the similar functionality • Brake control equipment- suppliers can be identified that will supply similar equipment, with the similar functionality
10.	Could your system comply with federal and state regulations and requirements, including the following? • Americans with Disabilities Act (ADA); • Buy America Act; • Hawaii seismic codes • Fire protection and safety evacuation regulations (including NEPA 130).
	Yes. ART will comply fully with all federal and state regulations and requirements, including; • Americans with Disabilities Act (ADA); • Buy America Act; • Hawaii seismic codes: and • Fire protection and safety evacuation regulations (including NFPA 130).
11.	What features does your system offer which could reduce the impact of construction?
	ART offers several features that may help to reduce civil construction impact and costs. Stations - Using the 2-car train configuration identified in the response to Question #3 above, a platform length of 120 feet would be adequate to meet the ridership. This feature reduces overall station size, footprint and construction time. The stations may be designed for future expandability. Utility Relocation - By selecting elevated guideway, utility relocation costs are drastically reduced compared with typical at-grade alignments. For any alignment, but particularly at-grade or underground, the 4th rail power supply

	system eliminates stray current and associated corrosion. Guideway - The light train contributes to smaller and lighter guideways that that can be erected quickly. Longer spans are feasible to reduce the number of columns. The grade capability can be used in hilly areas to minimize column height. Land Acquisition - The low noise, EMC and vibration signatures of ART enables the alignment to be closer to buildings, generally reducing the need to acquire land and demolish structures and trees. The technology provides considerable flexibility in designing the layout for the yard and fitting it in to the space available. Unattended operation allows the operator to use remote storage if the space is not conveniently available at the main depot. For a long system, remote storage enables better service at startup in the morning.
12.	Provide high resolution digital photograph(s) of your proposed system and proposed vehicles which are currently in service that can be used in presentations and publicly released reports (do not provide artist renderings). Please refer to Attachment C.
	II - COSTS
13.	If your system requires a proprietary guideway, please provide a typical list of quantities for piers, beams, walkways, and guidance mechanisms for 450 linear feet of dual guideway with a clearance of 20 feet above ground level. (Assumptions should include 150-feet long spans).
	No, our system does not require a proprietary guideway. The ART train is very adaptable to many construction methodologies. The ART train allows the selection of the most cost effective construction method available based on site conditions. The ART train is not constrained to 150 feet spans as mentioned above, this will allow greater line of site at ground level because fewer columns are needed that could obstruct vision. Developing a system with fewer columns and foundations not only reduces construction costs, but is less disruptive to the community and its businesses and residences, by reducing the projects footprint as well as the project schedule.
14.	Please provide information regarding actual costs of your vehicles and equipment for similar transit systems recently built or in revenue service.

[redacted]

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	• Are there any unique costs or proprietary technology considerations associated with your technology (positive or negative)? Please explain:

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The ART system offers a number of approaches that are not proprietary and can be used by others:

- Moveable frogs to reduce noise, vibration and maintenance costs;
- 4th rail power distribution to eliminate stray current corrosion issues;
- Radially steered bogies that reduce noise and wear in curves
- Wayside based resistors, rather than vehicle mounted resistors to absorb regenerated energy when the system is not receptive, to reduce vehicle weight.

The linear motor consists of two elements, the primary on the vehicle and the secondary on the wayside. The secondary for a rotary powered vehicle is on the vehicle as part of the motor. The secondary is proprietary and is unique to linear motor powered vehicles. The benefits of linear motor propulsion are numerous, including reduced vehicle maintenance, reduced vehicle weight, more flexibility in the design of civil structures, enabling the radially steered bogie, et cetera.

Vancouver's Skytrain system managed 2 short system extensions to the Expo Line for which Bombardier supplied only vehicles.

- Please tell us if your system would reduce the costs associated with right-of-way acquisition and/or reduce the impacts of traffic and the community when compared to an elevated 28 foot wide guideway built on single piers at approximately 150 feet spacing. Please explain:

Information Marked Proprietary

Information not supplied

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SYSTEM CHARACTERISTICS QUESTIONNAIRE
NOTICE TO FIXED GUIDEWAY SYSTEM VEHICLE SUPPLIERS

[redacted]

	III – TECHNOLOGICAL MATURITY
15.	Has your proposed transit system been proven in revenue service for at least five years? Please provide information and local contacts regarding some of those locations.
	Yes, please refer to Attachment D.
16.	Please provide the status of any regulatory approvals required or pending.
	Not Applicable
17.	Please describe to what extent your technology uses proven and recognized off-the-shelf components and sub-components that have been used in transit applications with similar levels of performance and reliability.

Information Marked Proprietary

Information not supplied

[redacted]

Information – proprietary

"Blocked out"

18. Please describe the status of the engineering and detailed design of your transit system and identify and technology risks.

ART technology design efforts began in the mid 1970's using a systems engineering approach, starting from a clean sheet of paper. There were no design limitations imposed by previously existing legacy designs or equipment. Starting in 1976, transit agencies, urban planners, politicians and other stakeholders were interviewed and asked what characteristics, system capabilities and design features they needed in a modern urban transit system. The results of this exercise were summarized in an operational requirements document, which defined in detail the system performance requirements required to achieve urban fit, environmental compatibility, and attractiveness to the public. System cost-effectiveness was an essential requirement.

Many of the staff involved in the development of ART technology came from the aerospace industry, and they brought with them proven systems engineering skills and principles well suited to the development of a complex new technology. These systems engineering principles were rigorously employed in the development of the ART system. All design decisions and technology choices that were made were evaluated from the overall system point of view, always considering the operational requirement and the need for cost-effectiveness. These design decisions, which included linear-induction motor (LIM) propulsion, radial steering bogies, lightweight vehicles and full driverless automation were ground-breaking and revolutionary at the time, but have been widely copied in the subsequent two decades.

A fully automated 7,480 feet (1.4 mile) oval test track was constructed by 1981, complete with 3% and 6% grades, a control center and maintenance facility, a passenger station, ATC, SCADA and communications equipment. Prototype vehicles were built and rigorously tested, and as the program moved from the

	development phase to the implementation phase, all production vehicles were also tested at this test track under full automatic control. This test track is still in use by Bombardier today. In spite of the fact that this was the first-ever implementation of a driverless steel-wheeled transit technology, the initial implementations of ART technology in Detroit, Scarborough (Toronto), and Vancouver in the mid 1980s achieved all of their design objectives and went into service according to schedule. This demonstrates the benefits of a systems engineering approach, competent project management and rigorous system testing using a modern test facility. In the early 1990s the larger MKII ART vehicle was developed, tested and subsequently put into service in Kuala Lumpur, Vancouver and at the JFK Airport in New York. Incremental development continues to add improvements and new features on an on-going basis, but ART technology is mature. As with any transit system project, application of the proven design will be required for the Honolulu system alignment layout and local requirements, but the Honolulu project will not require any new technology development.
19.	How do you typically guarantee the long term availability of replacement vehicles, systems equipment, and spare parts, as well as software support?
	The issues of long term availability of replacement vehicles, systems equipment, spare parts and software support are typically dealt with in the initial contract for the delivery and installation of the total transit system. It is quite typical that additional vehicle order options, that are valid for an extended time, subject to economic escalation factors, are priced and included in the initial systems contract. For spare parts, the initial systems contract typically includes a priced list of spares that would be included in the initial system delivery. Some contracts also require these spares, or functional equivalents, to be available for a reasonable period of time at the prices quoted, again subject to economic escalation factors. These spare parts are to ensure that both vehicles and other systems equipment can be maintained. Bombardier Transportation specializes in providing operations and maintenance services for rail transit systems, particularly those that it has supplied and constructed. Through these services, Bombardier is able to provide system availability guarantees that ensure that all of the delivered equipment is supported in a ready state of good repair in order to deliver high

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	availability. When others perform O&M on Bombardier-delivered equipment, Bombardier is often contracted to provide technical support services. Such technical support would include software support of customized software developed by Bombardier. Many initial systems contracts also require that customized software and other proprietary information related to systems equipment, be escrowed in the event that the company was no longer in the position to offer such services. This protects the end-user throughout the useful life of the transit system. As has also been described in this information package, the end user may, after the initial system is installed and operating, purchase additional vehicles and other system equipment from other suppliers. This equipment can be made compatible with the initially supplied equipment as the guideway is non-proprietary.

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INFORMATION PACKAGE
VEHICLE CHARACTERISTICS QUESTIONNAIRE

1.	General	
	• Electric propulsion	YES___√___NO______
	• High floor	YES___√___NO______
	• Fully automatic train operation (manual back-up)	YES___√___NO______
	• Bi-directional vehicles	YES___√___NO______
	• Third rail or equivalent current collection	YES___√___NO______
	• Dynamic braking	YES___√___NO______
	• Regenerative braking	YES___√___NO______
	• ADA compliant	YES___√___NO______
	• Level boarding	YES___√___NO______
	• Crash worthiness compliant	YES___√___NO______
	• Crash worthiness details provided	
	SEE ATTACHMENT E	YES___√___NO______
	• Fire performance to NFPA 130	YES___√___NO______
	• Emergency evacuation provisions	YES___√___NO______
	• Video monitoring and recording	YES___√___NO______
	• Automatic vehicle location / VMS system	YES___√___NO______
	• Vehicle life	30 years minimum
	• Details of noise mitigation measures provided	
	SEE ATTACHMENT F	YES___√___NO______
	• Vehicle maintenance and diagnostic system	YES___√___NO______
	• High reliability / availability	_____ mean time between train delays

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SEE ATTACHMENT G

- Low mean time and repair _____ mean time to repair

SEE ATTACHMENT G

- Expected vehicle life 30 years minimum
- Automatic passenger counting system YES √ NO
- Vehicle general arrangement drawings provided

SEE ATTACHMENT H YES √ NO

- Vehicle cross sections provided

SEE ATTACHMENTS I YES √ NO

- Vehicle to guideway interface details provided

SEE ATTACHMENT J YES √ NO

- Vehicle static clearance envelope provided

SEE ATTACHMENT K YES √ NO

- Vehicle dynamic clearance envelope provided

SEE ATTACHMENT K YES √ NO

- Vehicle length (over ends of vehicle) 109.580 ft.
- Vehicle length (over extended couplers) 110.564 ft.
- Vehicle width (maximum carbody) 8.441 ft.
- Vehicle width (over door threshold) 8.225 ft.
- Vehicle height (maximum) 11.286 ft.
- Maximum weight per vehicle (empty) 47,400 lbs.
- Ergonomic design as specified YES √ NO

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2.	Performance

Information Marked Proprietary

Information not supplied

	Response is CONFIDENTIAL and PROPRIETARY	
3.	Passenger Accommodations	
	• # of wheelchair spaces	2 spaces per car
	• Number of seats per car SEE ATTACHMENT L	32 seats (tip-up seats may be included
	• Number of standees per car at design Load of 4 passengers / m^2 (AW2)	102 standees
	• Total number of passengers per car (seated + Standees) at AW2 design load	134 total passengers
	• Air conditioned	YES___√___NO______

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	• PA system with auto-announcer YES___√___NO______ • Passenger to OCC communications YES___√___NO______ • Destination and passenger information displays YES___√___NO______
4.	Train Sets • Capable of coupling to make multicar trains YES___√___NO______ • Capable of failed train retrieval YES___√___NO______ • Capable of bidirectional operation from each car YES___√___NO______
	System Characteristics Questionnaire
1.	Super-elevation Limits What are the super-elevation requirements of your system? Please explain:
	There are no requirements or limits that are technology driven. Super-elevation is based on passenger comfort. It is generally useful to use the maximum super-elevation allowed to maximize curve speeds. Super-elevation is usually limited to 10% to allow comfortable stopping in a curve. This is a passenger comfort, not a technology feature.
2.	Route Geometric Constraints Does your system meet the following criteria" • Minimum horizontal radii o Maintenance Facility: 150 ft. o Elevated Structure: 400 ft. • Minimum horizontal lengths o Curves: 100 ft. o Tangents: 100 ft. o Spirals: 100 ft. • Vertical alignment: o Maximum station grade: 1% If not, please explain
	Yes. The system will meet and in most cases be less constraining than the values

	provided.
3.	Hours of Operation: Does your system meet the following: • 4:00 a.m. to 12:00 a.m. service day • 6:00 a.m. to 9:00 a.m. morning peak • 3:00 p.m. to 6:00 p.m. evening peak
	YES____√___NO______ Three hour peaks and 20 hour daily system operation are typical of ART system design.
4.	Station Dimensions • Platform length: 300 ft. maximum; with all doors on platform: YES___√____NO______ If not, please explain:
	Yes. Depending on the final configuration, a 120 ft platform may be appropriate.
5.	Emergency Evacuation Walkways Does your system meet all of the following criteria? • Must be along entire guideway • Must be accessible from vehicle • Minimum evacuation walkway width: 2' – 6" • Minimum evacuation walkway height: 6' – 8" • Minimum maintenance walkway width: 2' – 0" • Minimum maintenance walkway height: 6' – 8" • Walkway width is clear of the vehicle dynamic envelope • Walkway around switches meet state and local requirements YES___√___NO______ If not, please explain:
	Yes, the criteria are consistent with typical ART system design criteria.

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6.	Traction Power
[redacted]	
7.	Train Control / Signal System Can your system be supplied with a bi-directional fully automatic train operation with manual back-up? YES____√___NO______ If not, please explain:
	Yes. The standard recommended configuration, full ATO and emergency manual.
	Please provide examples of existing installations in revenue service. Please refer to Attachment D.
8.	Communications • Radio system YES___√___NO______ • Passenger communication system to OCC/Operators YES___√___NO______ • On-board Closed Circuit Television YES___√___NO______ • Fire & emergency management system YES___√___NO______ • On-board ADA message system YES___√___NO______

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9.	Noise and Vibration • Can your system meet or exceed the levels and criteria as established by the FTA *Transit Noise and Vibration Impact Assessment Guidance Manual* and the goal of 75 dBA at stations? YES___√____NO______ Please explain how this is achieved?
	Yes. Both noise and vibration are affected by similar considerations. Compliance to the noise and ground vibration criteria as specified in the FTA Transit Noise and Vibration Impact Assessment Guidance Manual requires knowledge of the land use categories along the right of way, existing noise levels along the right of way, and ground transmission characteristics along the right of way. Bombardier ART trains are designed to produce low wayside noise levels. Wayside noise is reduced through the use of continuously welded rail without rail joints, movable frogs, tight tolerances on rail installation, low parapets (without noise surface treatment), avoidance of wheel flats through use of linear motor propulsion and through reduction in the number of emergency applications, insulated under-floor treatment and the radially steered bogie. Bombardier adheres to a strict noise management plan for the vehicle to ensure that the vehicle, as delivered, meets the requirements. At stations, many of these factors also apply to provide mitigation. The most important factors are high floors and platform doors. Acoustic surface treatment has not been required.
	If not, please explain
	• What noise level is achieved from your system operating on elevated guideway at 55 mph, measured 50 feet from the guideway centerline? <75 dBA Cite a location where such a level can be measured:
	The wayside noise criterion of 75 dBA is met at all points in the system.
10.	Other Characteristics:

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Does your system provide the following?

- Fully accessible and meets all ADA requirements, including the regulatory requirements of 49 CFR Part 38, Transportation for Individuals with Disabilities;
- Meets all Buy America requirements; and
- Cost-effective to operate and maintain

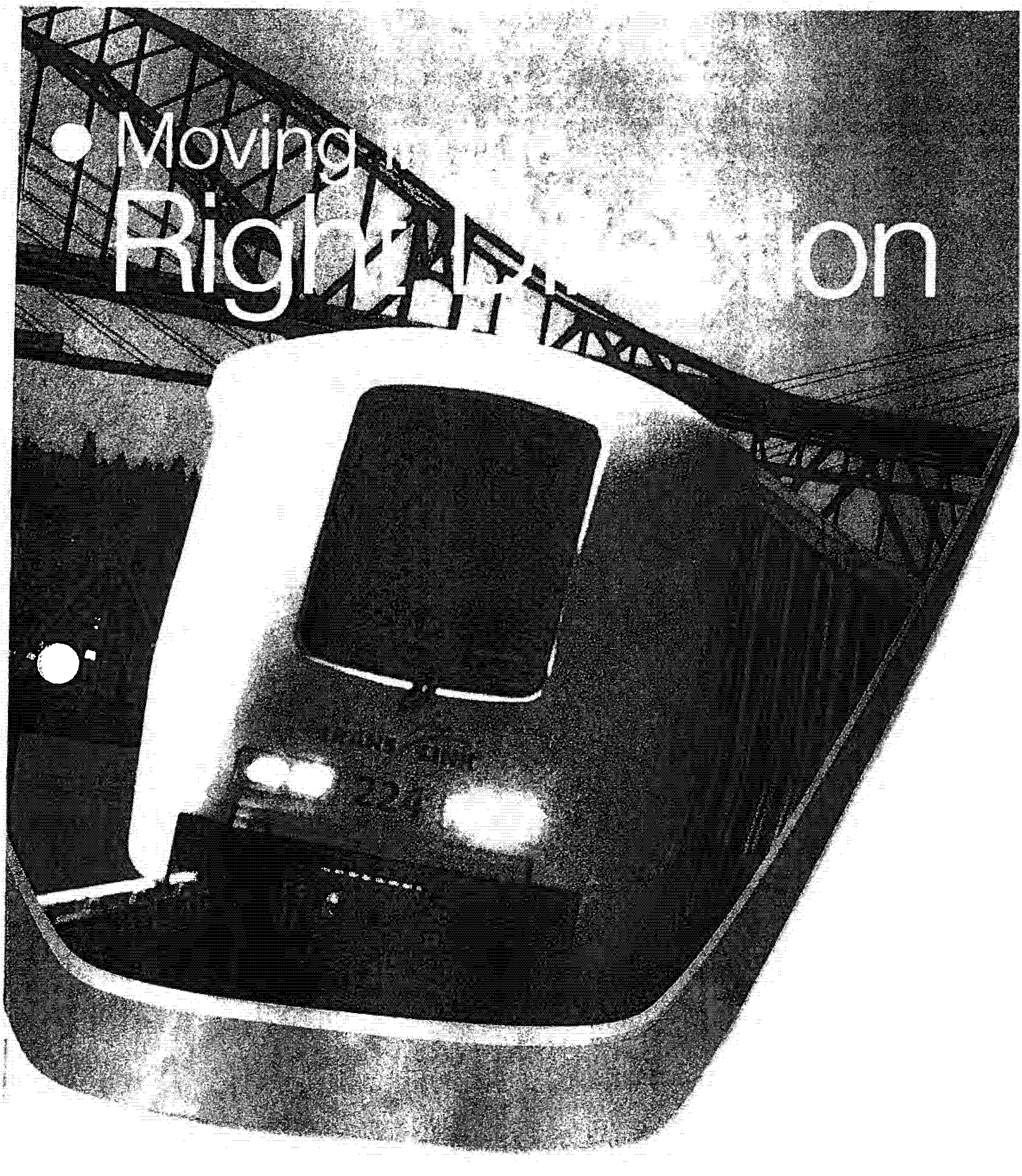
YES___√___NO______

If not, please explain

Please explain how cost-effectiveness is achieved:

A number of design and operational approaches contribute to low overall cost-effective operation and maintenance. Some examples are provided;

- Automatic unattended operation: Roaming attendants can address client needs and be available for intervention if required.
- Subsystem redundancy: Equipment redundancy on trains and power supply result in an immobilized train being an extremely rare event. Train status is monitored and self-removed from service, usually at the next service reduction.
- Linear Motor Propulsion: The elimination of gear boxes and motor bearings reduces maintenance requirements. The "direct drive" propulsion reduces wear effects on wheels and rail due to freedom from the need for friction to deliver thrust.
- Radially steered bogie: In particular, flange wear is eliminated and wheel truing is not required as frequently and only a small amount is needed to be removed. This increases wheel lift. Wheel flats are eliminated in normal service.
- The Preventive Maintenance program: Optimized because of continuous status monitoring of equipment.
- Integrated bogie design: A philosophy that replaces wheels, bearings and discs at the same time.
- In general equipment is modularized and line replaceable, minimizing maintenance effort.



Advanced Rapid Transit

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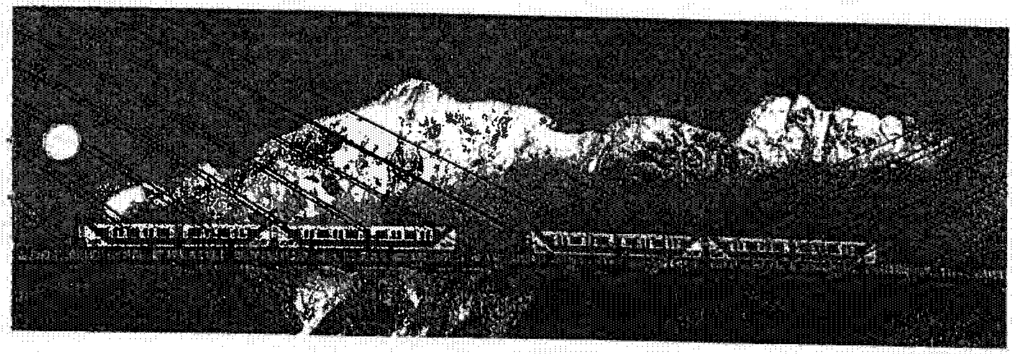
‹We Help Cities Breathe›



Advanced Rapid Transit (ART) is an alternative way to move people. Blending into any urban setting, ART systems attract riders, protect the environment, and give community leaders new options to meet transit mobility challenges.

Fully automated and driverless, ART medium capacity systems have a proven track record of safe operation, service dependability, and low operating costs. Around the world, ART systems move 150 million people every year in major metropolitan cities

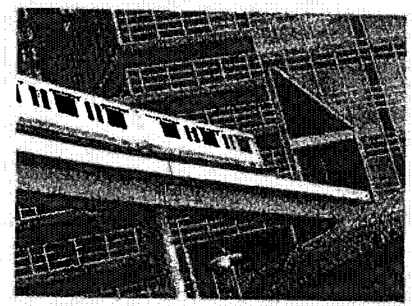
An alternative way to move people

Advanced Rapid Transit was specifically designed to fill the gap between street running trams (low capacity) and heavy rail metros (high capacity). ART excels as a medium capacity transit system on dedicated guideway, whether at grade, elevated or underground.

A Good Neighbour
Lighter trains, slender guideways, unobtrusive stations blend attractively with or into planned and existing buildings, structures and streetscapes. ART boasts the lowest wayside noise of any rail transit system.

A Rewarding Passenger Experience
Frequent and dependable service that riders choose to whisk them safely, comfortably and quickly to their destinations. Above the traffic, passengers enjoy the urban vista

A Sustainable Partner
Climate-friendly and a non-polluting alternative to automotive traffic, trucks and air travel. ART offers superior service that entices people from their cars.



More riders Less Cost

The transit mobility challenge

More Affordable Rail Transit

- ART typically requires half the capital cost of a conventional underground metro system.
- ART operates on small curves and steep grades to allow greater use of less expensive elevated guideway.
- ART permits smaller, less expensive stations.
- ART reduces operating costs. When compared to systems that carry more people, published data shows that ART costs less to operate and maintain for every passenger carried

Advanced Technology

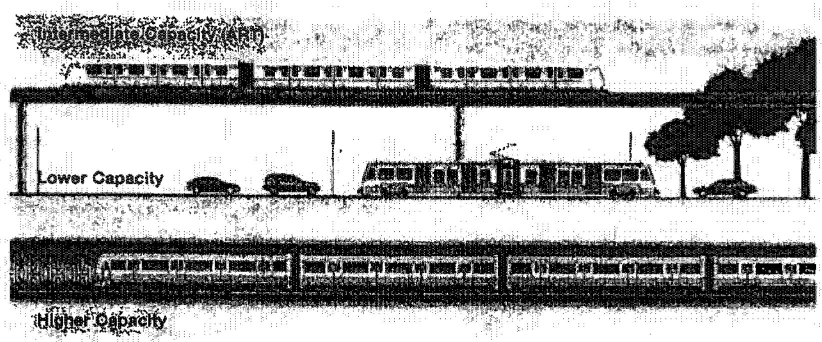
The basis of a successful transit system

ART's revolutionary Linear Induction Motor (LIM) propulsion system and fully automated driverless train operation delivers in excess of 30,000 passengers per hour per direction, round the clock, and consistently in all weather conditions.

Attractive to Riders

The measurement of success

Passengers want consistent and dependable service, with short wait times at stations and quick journey times. ART offers all of this and more - frequent off-peak service, train staging for special events and responsiveness to unanticipated passenger flow.



Bombardier's ART fills the capacity gap between heavy metro and street running systems

An affordable way to move people

Lower Capital Costs

A fully automated Advanced Rapid Transit line carries the same number of passengers as three street-running light rail systems using fewer trains and with a lower infrastructure cost.

When compared to underground metro, the infrastructure cost of an elevated Advanced Rapid Transit line is often 50 per cent lower. This is especially advantageous if the large ultimate passenger carrying capacity of a metro system is not a requirement.

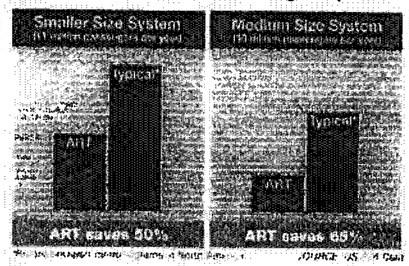
Lower Annual Operations and Maintenance Costs

During the development of the Advanced Rapid Transit technology minimizing operations and maintenance costs was a major system design requirement. ART O&M costs per passenger trip are a fraction of typical light and heavy rail systems with similar ridership.

The daily operation of most public transportation systems is heavily subsidized around the world. Advanced Rapid Transit technology makes operation more affordable, and in some cases, pays for the daily operation through the fare box

Because of the low cost of operation, better service is provided in the off-peak hours, and therefore is attractive to riders for the full day

Transit Authority Cost Per Passenger Trip



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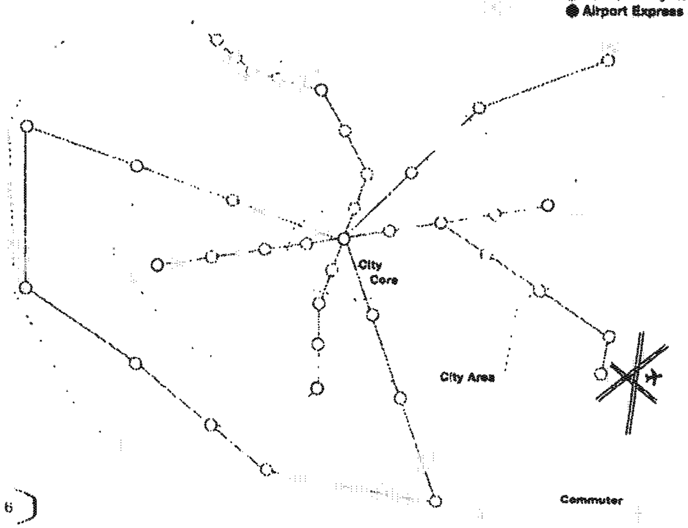
‹A Catalyst for Urban Development›

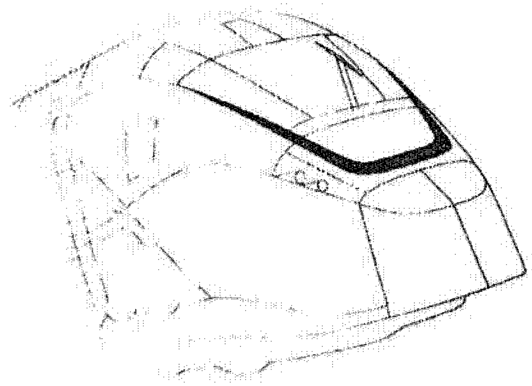
Advanced Rapid Transit is designed to meet the requirements of line-haul operation in the medium to high capacity range. This application typically carries passengers into and out of the downtown area for work, shopping or entertainment. An attractive system will shape development in an urban area, based on sound city planning. It also, over time, encourages residential development in the city centre enabling people to take full advantage of diverse employment opportunities and other activities within the region. The counter-flow makes the system even more affordable.

	●		●	AirTrain JFK
			●	Beijing Express
	●			Detroit Downtown People Mover
●				Rapid KL – Kelana Jaya Line
	●			Scarborough Rapid Transit
●				Vancouver SkyTrain Expo Line
●				Vancouver SkyTrain Millennium Line
●	●			Yongin EverLine

- Line Haul System
- Collector/Distributor/Feeder System
- Commuter/Regional System
- Circulator System
- Airport Express System



‹Bombardier Transportation
The Climate is Right for Trains›



Bombardier is dedicated to developing, manufacturing and servicing advanced transportation solutions for today's and tomorrow's railways.

As the global leader in rail technology, Bombardier places environmental sustainability firmly at the top of the agenda. Our products and services combine energy conserving technology with optimal safety, reliability and cost efficiency. They are designed for sustainable mobility throughout their lifecycle.

Our portfolio of rolling stock and services encompasses passenger vehicles for urban and mainline operations, locomotives, bogies, rail control solutions, propulsion and complete transportation systems, as well as vehicle modernization and maintenance.

Over 100,000 vehicles in operation worldwide attest our unique strengths in project management and innovation, design and technology. For decades we have enabled millions of people everyday to reach their destinations in comfort and style.

Bombardier is a truly international business, which provides local support. Present in more than 60 countries and with 29,000 employees worldwide, we strive to be the partner of choice for all the world's rail operators.

Headquartered in Berlin, Germany, Bombardier Transportation is part of Canada-based Bombardier Inc. It generates annual revenues in excess of US$ 6 billion.

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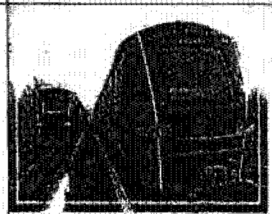
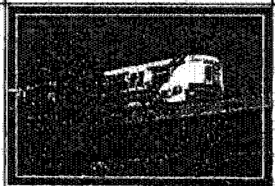
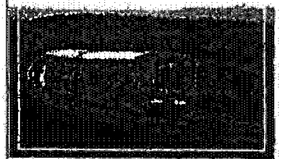
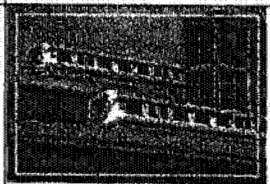
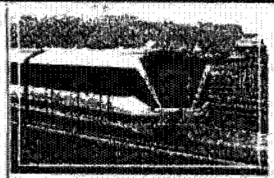
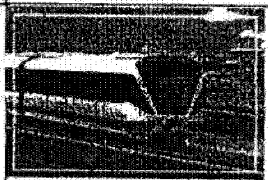
Experience List

		Project Title	Description of Project	Name of Owner, Co. Address, phone # and contact person CONFIDENTIAL	Award Date	Contracted deadline for completion	Actual Completion Date
ART		**Yongin Everline** **Yongin, South Korea**	The new 18.5-km (11.5-mile) line will link Seoul's subway system, via the Yong-in City, with Everland, one of the world's largest amusement parks. The fleet of 30 Advanced Rapid Transit (ART) vehicles will serve 15 stations on elevated double-track guideway. Bombardier's scope includes: • 30 ART vehicles • CITYFLO® 650 automatic train control for the entire system • communications system • power supply and distribution system • automatic fare collection • testing and commissioning • system training and operations and maintenance manuals • support for Operations and Maintenance (O&M) planning. • ten years of O&M (four 5-year options)	~~Yongin Rapid Transit Co. Ltd.~~	July 27, 2004	Spring 2009	
ART		**Beijing Capital International Airport Link**	Awarded to Changchun Railway Vehicles (CRC) by the Beijing Dongzhimen Airport Express Rail Co. Ltd. Bombardier's scope includes: • vehicle system engineering and integration • design and manufacture of the bogies • propulsion and braking system CRC will manufacture the 40 ART MK II vehicles		June 28, 2005	Summer 2008	
ART		**Vancouver SkyTrain Expo Line**	The 29-km Expo Line has moved passengers safely and reliably since 1986 and is considered Bombardier's landmark for driverless urban systems in North America. For the initial phase of the Expo Line, Bombardier was the turnkey supplier of the complete transportation system. The design-build-operate-maintain contract included: • 114 driverless ART MK I vehicles • automatic train control • communications systems • power supply and distribution • civil design and construction of the dual-track guideway • design and construction of the maintenance control facility and 15 stations • project management • systems engineering and integration • testing and commissioning • operations and maintenance of the system for the first 44 months of service	y	June 1981		Phase 1: January 1986 Phase 2: April 1991 Phase 3: September 1995

		Project Title	Description of Project	Name of Owner, Co. Address, phone # and contact person CONFIDENTIAL	Award Date	Contracted deadline for completion	Actual Completion Date
ART		Vancouver SkyTrain Millennium Line	The Millennium Line is a 20.3-km, dual-track extension of the driverless Vancouver SkyTrain, which added 12 elevated stations, 8 sub stations and 60 new vehicles to the System. Bombardier provided all the elements of the complete transit system, including: • 60 ART MK II vehicles • automatic train control • communications system • power supply and distribution system (600 Vdc) • trackwork and guideway elements • system engineering and integration • platform security in stations • linear induction motor reaction rail • testing and commissioning • project management of the works	British Columbia Rapid Transit	Contract award: (E&M) August 1999 (vehicles) October 1998	First Vehicle delivery: Oct 2000 Phase I in service: Jan 2002 (28 months after contract award) Phase II in service: Aug 2002	First Vehicle delivery: October 2000 Phase I in service: January 2002 Phase II in service: August 2002
ART		AirTrain JFK International Airport, New York, USA	The 14-km AirTrain JFK System connects 10 fully enclosed stations and links all terminals in JFK's Central Terminal Area with two branches that interface with New York's regional transit system. Both branches use a common section between the central terminal area's 2.5-km loop and the junction. Bombardier's scope included: • project management of Bombardier's scope • system integration engineering and design • 32 Advance Rapid Transit (ART) MKII Vehicles • signalling • power supply and distribution • communication • automatic fare collection • platform screen doors • system commissioning and testing • training and manuals • workshop equipment • five years of O&M with two 5-year options.		Contract Award: May 1998	Dec. 2002	Dec. 2003

AR00085463

Bombardier
Experience List

		Project Title	Description of Project	Name of Owner, Co. Address, phone # and contact person CONFIDENTIAL	Award Date	Contracted deadline for completion	Actual Completion Date
ART		PUTRA LRT (KL LRT System 2) Kuala Lumur, Malesyle (currently knew as Kelane Jeya Line)	Bombardier's share of the project included · 70 Advanced Rapid Transit KM II vehicles · enboard and wayside automatic train control · communication systems · platferm Screen deors · linear induction meter (LIM) reaction rail · special tools, test and maintenance equipment · systems engineering and integration · project management · testing and commissioning · Operations and Maintenance (O&M) training of staff · O&M advisory suppert during revenue service		Oct. 1994	Section 1: September 1998 Section 2 & 3: Summer 1999	Section 1 in service: 1998 Section 2 & 3 in service: 1999
ART		Kelane Jaya Line Expansion	Bombardier's scope included: 88 ART MK II vehicles 52 ART MK II vehicles (option) Electrical and Mechanical (E&M)		Vehicles: Award date Oct. 2006 Option date Oct. 2007 E&M Award date August 2007	Vehicles Sept. 2008 - June 2010 E&M Q1 2009	
ART		Detroit Downtown People Mover Detroit, Michigan, USA	The Detroit People Mover employs UTDC's unique Advanced Light Rail Transit (ALRT) technology to move people throughout the downtown business district on a single-track, elevated loop. Powered by quiet linear induction motors, the steel-wheeled vehicles also operate under automatic control on exclusive rights-of-way. The combination of moving block signalling and computer control gives the People Mover an excellent on-time service records. · 12 ALRT vehicles · 2.9 mile loop system		1982	1987	Jul-87

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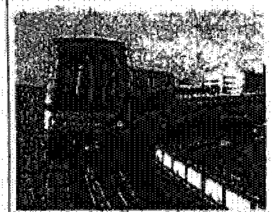
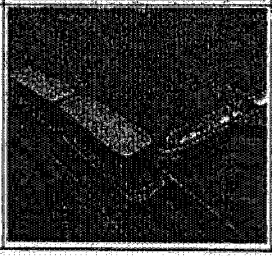
Bombardier
Experience List

		Project Title	Description of Project	Name of Owner, Co. Address, phone # and contact person CONFIDENTIAL	Award Date	Contracted deadline for completion	Actual Completion Date
CITYFLO 650		**San Francisco Automated People Mover San Francisco, California, USA**	3 miles dual elevated guideway 38 CX100 style vehicles 9 passenger stations, 2 Regional ATCs, Automated Maintenand Yard		1999	2003	Feb-03
CITYFLO 650		**Seattle Tacoma Automated People Mover Seattle, Washington, USA**	2 Regional ATC's, 22 CX-100 vehicles, 9,000 ll guideway, 8 stations		2000	2004	North Loop : May 2003 South Loop: Nov 2003
CITYFLO 650		**Dallas Fort Worth Automated People Mover Dallas, Texas, USA**	World's Largest Airport People Mover: 4 Regional ATC's, 64 Innovia vehicles, 1 maintenance vehicle, 6 miles dual guideway, 12 stations, automated yard		2001	2005	May-05

Information Marked Proprietary

Information not supplied

Response is CONFIDENTIAL and PROPRIETARY

BOMBARDIER

TransLink

2009 SkyTrain MKII Vehicles Expansion
Advance Rapid Transit (ART) Vehicles

Vehicle Noise Control Plan

Confidential and Proprietary

Information Marked Proprietary

Information not supplied

Revision Log

Revision	Date (yyyy-mm-dd)	Description of Changes
00	2007-06-11	First issue

Availability and Reliability

ART was conceived as a system. In this context, availability refers to the capability to maintain the specified service level. Reliability refers to equipment failures and the subsequent maintenance activities.

The criterion for availability is stated as train distance traveled between immobilizations and this is intended to be a rare event.

The criterion for reliability is stated as the train distance traveled between train self removals and this is intended to minimize maintenance effort.

System availability is achieved through the design and operating procedures:

- Provide equipment redundancy
- Ensure automatic transfer of function, for example on the on-board ATC equipment in the event of failure of one unit
- Monitor train equipment status on a real-time basis
- Enable remote reset of some vehicle equipment
- Ensure electromagnetic compatibility is achieved
- For all system equipment follow rigorous inspection and preventive maintenance procedures

System reliability is achieved through design and operating procedures as well:

- Specify high levels of reliability for equipment
- Ensure operation in a benign environment
- Ensure electromagnetic compatibility is achieved
- For all system equipment follow rigorous inspection and preventive maintenance procedures

In addition, to maintain service levels, scheduled operations must be maintained. ART is designed to cope with small delays, including passenger induced delays, by incorporating schedule catch up capability. The measures include higher speed capability and dwell reduction, both implemented automatically.

The mathematical definition of system availability has not been standardized in public transit applications; consequently it is not meaningful to compare data from different systems. Whatever formula is used, however, ART will show superior results.

Hitachi/Mitsui

Information Marked Proprietary

Information not supplied

Honolulu High-Capacity Transit Corridor Project

RESPONSE TO
REQUEST FOR INFORMATION (RFI 001)
INFORMATION PACKAGE

DOCUMENT NO P.HLL.HTC.0001

January 2008

HITACHI
Inspire the Next

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IHI

January 24, 2008

Mary Patricia Waterhouse, Director
Department of Budget and Fiscal Services
Division of Purchasing
530 South King Street, Room 115
City Hall
Honolulu, Hawaii 96813

Reference: Notice to Fixed Guideway System Vehicle Suppliers
Request For Information (RFI 001)
First Project
Honolulu High-Capacity Transit Corridor Project

Subject: **IHI Corporation Response to RFI 001**

Dear Ms. Waterhouse:

IHI Corporation is pleased to provide the following response to your RFI 001. This is a dynamic project which requires the skills and experience of only a highly capable Contractor with decades of transit vehicle and system design, development, implementation, operations and maintenance experience. IHI has the proven background to exceed the expectations of the City and County of Honolulu (City) for this program.

The proposed IHI transit solution combines only the latest, proven technologies and subsystems designed to provide decades of exceptional and cost effective operation. Vehicles feature spacious, comfortable, and fully ADA compliant interiors combined with exceptional window area to enhance rider experience and security. Vehicle exteriors are ultra sleek and will provide exceptional aesthetics complementing the City's theme(s). Further, the proposed transit system's innovative and proven side guidance guideway technology provides ride quality unmatched by typical systems thereby adding to the City's patron satisfaction.

Point of Contact: Atsushi Yagi
Manager
IHI Corporation
Transportation System Project Division
Toyosu IHI Building 1-1, Toyosu 3-chome, Koto-ku
Tokyo 135-8710 JAPAN
Tel: +81-3-6204-7255
Fax: +81-3-6204-8683
Email: atsushi_yagi@ihi.co.jp

IHI/NTS, with its extensive technical background, is fully committed to applying this expertise to the Honolulu High-Capacity Transit Corridor Project. Should you have any questions or need additional information, please feel free to contact me.

Very truly yours,

Atsushi Yagi

Attachment

INFORMATION PACKAGE
TECHNOLOGY CHARACTERISTICS QUESTIONNNAIRE

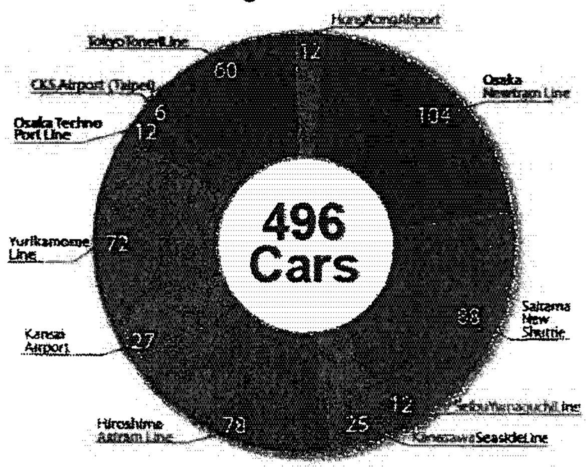
INTRODUCTION

IHI Corporation was established in 1853 as a shipbuilding manufacturer and has evolved into a leading manufacturer of complex industrial equipment and facilities. Today, IHI has six operating units – Logistics Systems and Structures Operations; Industrial Machinery Operations; Energy and Plant Operations; Aero-Engine and Space Operations; Shipbuilding and Offshore Operations; and Other Operations.

On February 3, 2003, IHI established Niigata Transys Co., Ltd. (NTS) from certain assets including the rolling stock operations of Niigata Engineering Co., Ltd. as a subsidiary company under Logistics Systems and Structure Operations. This combination of IHI with its more than 150-year history as a supplier of complex engineered products and NTS with more than two decades experience providing APM solutions resulted in a highly competitive enterprise. Today, IHI is a leader in the APM field with eleven (11) systems throughout the world under contract or completed as indicated in Figure A.

IHI's experience designing, manufacturing, supplying performing system integration, testing and commissioning of APM Operating System Technologies is shown in Figure B for existing systems; and the Toneri Line and Hong Kong International Airport Line extension, which are under construction. For each project, IHI is/was responsible for installation management of their scope of work on the systems presented. IHI is committed to take the same scope for the City and County of Honolulu.

Figure A



Tokyo Toneri Line
- Completion: 2007
- Location: Tokyo, Japan
- Miles: 6.1
- Stations: 13
- Application: Urban

CKS Airport (Taipei)
- Completion: 2003
- Location: Taipei, Taiwan
- Miles: 0.4 x 2 lines
- Stations: 4
- Application: Airport

Osaka Techno Port Line
- Completion: 1997
- Location: Osaka, Japan
- Miles: 0.8
- Stations: 3
- Application: Urban

Yurikamome Line
- Completion: 1995
- Location: Tokyo, Japan
- Miles: 9.2
- Stations: 16
- Application: Urban

Kansai Airport
- Completion: 1994
- Location: Osaka, Japan
- Miles: 1.4
- Stations: 6
- Application: Airport

Hiroshima Astram Line
- Completion: 1994
- Location: Hiroshima, Japan
- Miles: 11.5
- Stations: 21
- Application: Urban

Hong Kong Airport
- Completion: 2005 (Vehicle), 2008 (Extension)
- Location: Hong Kong, China
- Miles: Extension of 0.8
- Stations: 2
- Application: Airport

Osaka Newtram Line
- Completion: 1981
- Location: Osaka, Japan
- Miles: 4.1
- Stations: 8
- Application: Urban

Saitama New Shuttle
- Completion: 1983
- Location: Saitama Pref., Japan
- Miles: 7.9
- Stations: 13
- Application: Urban

Seibu Yamaguchi Line
- Completion: 1985
- Location: Saitama Pref., Japan
- Miles: 1.8
- Stations: 3
- Application: Urban

Kanazawa Seaside Line
- Completion: 1989
- Location: Yokohama, Japan
- Miles: 6.6
- Stations: 14
- Application: Urban

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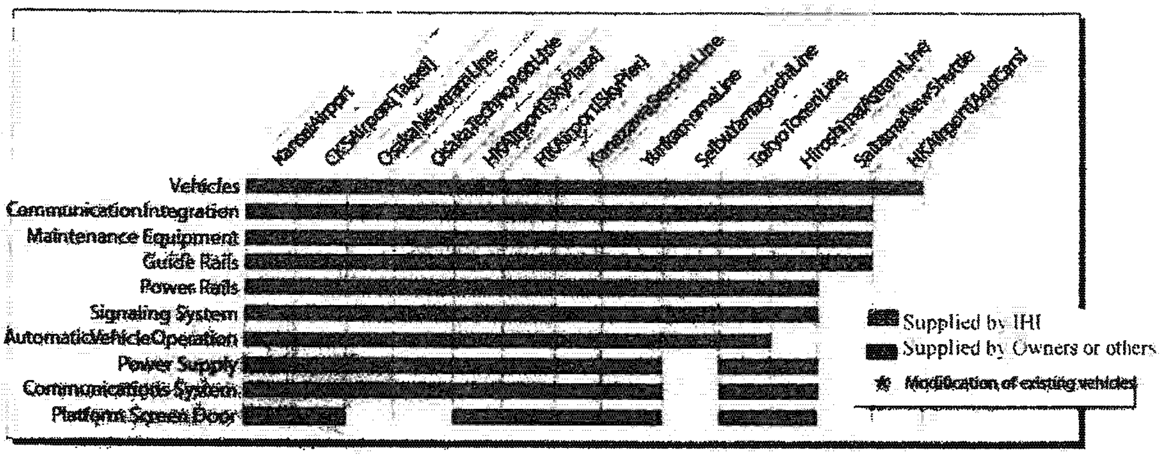
Figure B


Vehicles
Communication Integration
Maintenance Equipment
Guide Rails
Power Rails
Signaling System
Automatic Vehicle Operation
Power Supply
Communications System
Platform Screen Door
Supplied by IHI
Supplied by Owners or others
* Modification of existing vehicles

I – FUNCTIONALITY

1. *Please provide a brief product description of your system, including any special guideway general arrangements, cross sections and technical details.*

IHI's Automated Train System will be a cost-effective, reliable solution to help the City and County of Honolulu (hereinafter referred to as "the City") efficiently manage increasing passenger demand and reduce anticipated traffic congestion throughout the City. The IHI system will be seamlessly integrated along the entire proposed 20-mile route. IHI's proven experience with system integration will ensure on-time, on-budget delivery of the First Project and any subsequent system expansions.

The IHI Solution

IHI will provide a transportation system solution that meets and/or exceeds the needs and requirements of the City, including:

- A fully-automated, driverless, rubber-tired people mover system leveraging proven technology and system integration methodology;
- A system which exceeds required performance standards, including cruising speed, operating system capacities, station platform lengths, and others;
- Optimized passenger comfort resulting from a spacious cabin structure, heat-resistant composite carbody, and substantial design placement of on-board equipment located underfloor;
- A proven and unique IHI integration capability;
- A demonstrated ability to effectively interact and coordinate with civil works and other professionals during project implementation activities;
- Extensive involvement of local, Honolulu area professionals, labor, and other businesses.

The Automated Train Operating System will operate on a concrete running surface and utilize side guidance. The system will operate on a dual-lane guideway serving all stations along the proposed route. In addition to a normal pinched loop configuration operating mode, the system can accommodate any other required operating and failure management modes. The system operating mode will normally be selected at Central Control, having automatic and override capability. Vehicle operation will be bi-directional having equal performance in either direction.

The basic hardware for the Automated Train Operating System by IHI will be designed to achieve simplicity of installation, operation, and maintenance. Vehicle steering and guidance will be achieved by guide wheels located on both sides of the vehicle which follow 'H'-shaped, steel guide rails anchored on both sides of the guideway for superior ride quality. In addition, the IHI system technology utilizes a simplified and proven switching mechanism designed to further enhance system reliability and reduce costs.

2. *Are there any limitations with your system providing the required level of service along the First Project's 20 mile route selected and station spacing adopted? If so, please explain.*

   Based on the information provided in the RFI, no limitations are foreseen with IHI's system.

3. *Can your system carry a maximum of 9,000 pphpd during the peak periods? Please provide the number of vehicles per train, number of trains and headways for each case. Also identify the square feet per seated and standing passenger assumed.*

   The IHI system can comfortably and efficiently transport up to 9,000 pphpd during peak periods. Based on 5 square feet per seated passenger and 2.7 square feet per standing passenger, and also given the RFI-stated minimum seated ratio of 50% of the passenger floor area, IHI's vehicles can accommodate up to 80 passengers per vehicle. See Appendix: 'Vehicle General Arrangement' for further details.

   For a two-minute headway, IHI would provide trains of a four (4) vehicle consist, with 20 trains required per direction. For a three-minute headway, the system trains would be of a six (6) vehicle consist, with 14 trains required per direction.

4. *Can your system deliver an average end-to-end travel time of 40 minutes for the First Project with a 20 second dwell time at each station?*

   The IHI system can deliver an average end-to-end travel time of approximately 40 minutes, with a 20 second dwell time at each station.

5. *Can your system accommodate guideway switching and crossing over with 2 minute main line headways? If your system is other than a conventional rail technology, please provide details of the guideway switching apparatus (from an existing operating system) for both turnouts and crossovers, including general arrangement drawings, mechanism details and costs along with times to change routes.*

   IHI can seamlessly accommodate guideway switching / crossing over as part of a pinched loop configuration, even with 2 minute main line headways. The IHI switching system uses a simple, passive vehicle mounted switching wheel which acts together with wayside elements on the guideway. The simple design ensures smooth transitions and stability during switching. All dynamic parts are lightweight and similar in design to conventional railway switching mechanism, which will ensure high reliability. In addition, all switches are bi-directional. An oblique view showing a representative switch is shown in Figure: 'Switch Oblique View'.

   As illustrated in Figure: 'Switch Diagram', the switching system utilizes an automatic switch machine and fixed and movable blades anchored to the guideway as well as switch wheels attached to the vehicle. The movable blades used to switch trains from one line to another are activated by an electrically powered switch machine based upon the standard automatic railway switching machine design. Once activation of the switch is complete, movable, curved blades form a seamless guidance surface for superb ride quality forming a unique feature of the IHI system (see Figure: 'Switching Mechanism' for further details).

Figure: Switch Oblique View

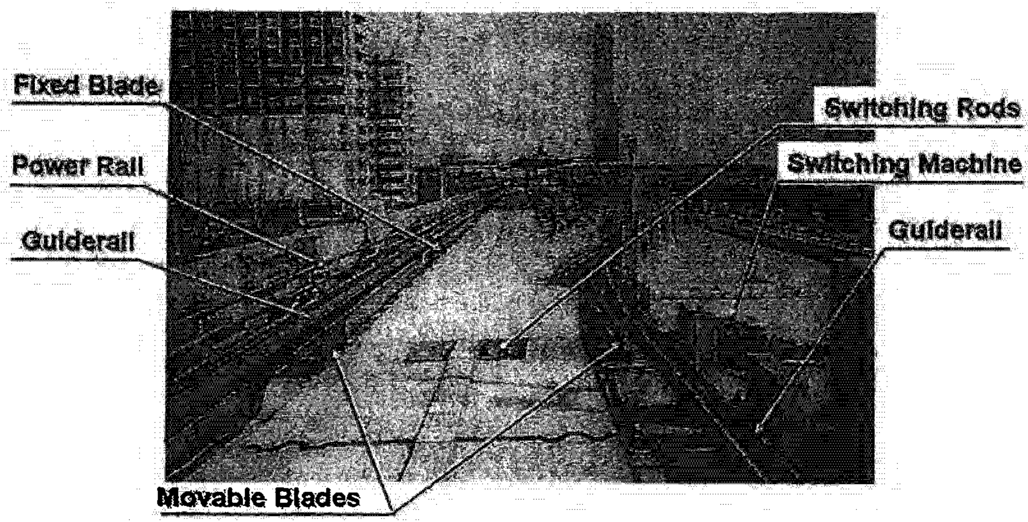


Figure: Switch Diagram

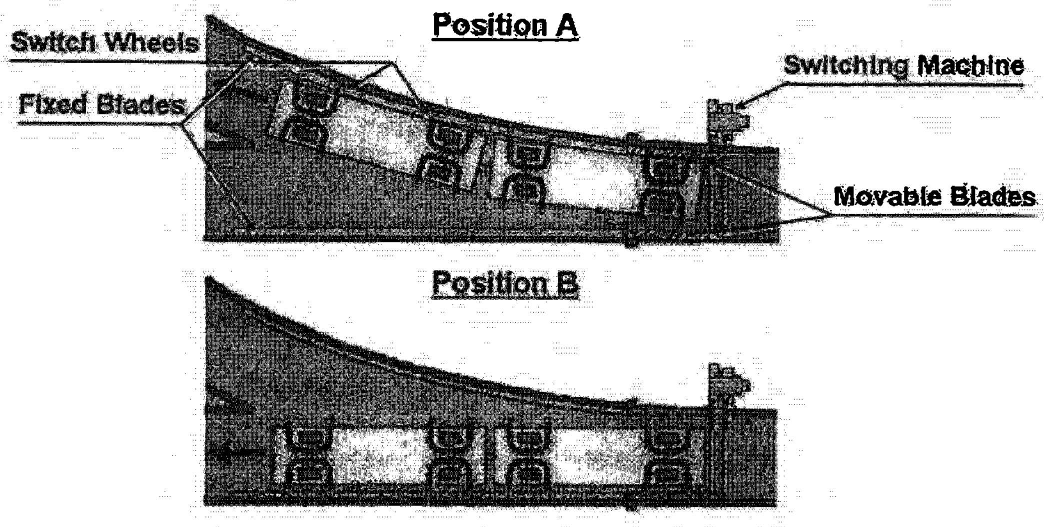
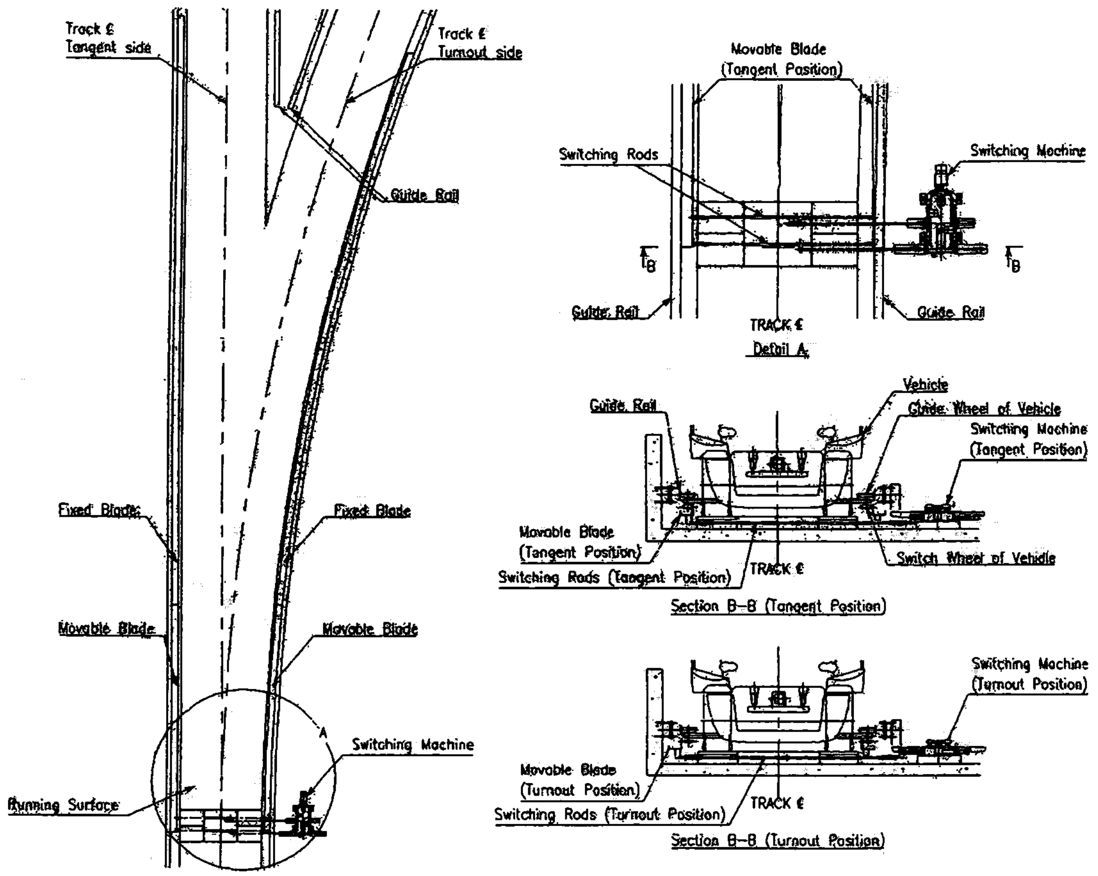


Figure: Switching Mechanism



6. *If your system is other than a conventional rail technology, please provide a general layout and cross section of an existing storage yard and maintenance facility for a system of similar size and passenger loads.*

   IHI has extensive experience designing and constructing large system maintenance facilities and storage yards. In general, the footprint required of such facilities is substantially smaller than conventional steel wheel / steel rail systems. IHI would be pleased to provide more detailed information during subsequent project stages.

7. *Can your system support future expansions and extensions?*

   IHI utilizes a proven and unique integration capability which includes a demonstrated approach to providing 24-hour-per-day service operation during transit system expansions. Any transition phases to support future expansions and extensions will be carried out seamlessly using IHI's operational flexibility and independently operable vehicles.

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In addition, DC traction power is provided to the power rail utilizing a segmented design which provides power to discrete sections. While providing for failure management safety, this feature allows for future ease of system expandability.

Further, the IHI system is controlled by a state-of-the-art ATC subsystem utilizing the latest in Communication Based Train Control (CBTC) technology. CBTC is a radio-frequency based system which integrates both automation and communication into a solid and proven technology (bi-directional communication and standard network communication). The modular capability of the CBTC (logic block design) does not depend upon nor is it restricted by guideway circuits like conventional fixed block. Therefore, it can be easily upgraded and extended to new stations to accommodate anticipated system expansion at very low cost and with no disruption to system service.

8. *Can other manufacturers provide interoperable vehicles in a future procurement? If so, please provide the names of up to four other manufacturers of compatible equipment.*

The IHI system is inherently flexible and designed to provide optimum lifecycle customer value. Further details concerning this topic can be reviewed during subsequent discussions.

9. *Can multiple manufacturers provide compatible interfacing systems equipment in a future procurement? If so, please provide the names of up to four other manufacturers of compatible train control/signaling, traction power distribution, propulsion and braking control equipment.*

The IHI system is inherently flexible and designed to provide optimum lifecycle customer value. Further details concerning this topic can be reviewed during subsequent discussions.

10. *Would your system comply with federal and state regulations and requirements, including the following?*

- *Americans with Disabilities Act (ADA);*
- *Buy America Act;*
- *Hawaii Seismic Codes;*
- *Fire Protection and safety evacuation regulations (including NFPA 130).*

IHI's system will comply with all applicable federal, state, and local regulations and requirements, including ADA, Buy America, Hawaii Seismic Codes (UBC Zone 2B, Peak Ground Acceleration=0.18g), Fire Protection and safety evacuation regulations including NFPA 130, the latest ASCE APM Standards, and other.

11. *What features does your system offer which could reduce the impact of construction?*

Based upon proven similar system implementation experience, IHI knows how to minimize the impacts of construction. Through working closely with Honolulu City and County officials and departments, our construction management methods function to eliminate unnecessary traffic inefficiencies and maximize safety to impacted pedestrians and individuals.

12. *Provide high resolution digital photograph(s) of your proposed system and proposed vehicles which are currently in service that can be used in presentations and publicly released reports (do not provide artist renderings).*

IHI would be pleased to provide photographic and other graphical information during subsequent program phases.

II – COSTS

13. *If your system requires a proprietary guideway, please provide a typical list of quantities for piers, beams, walkways and guidance mechanisms for 450 linear feet of dual guideway with a clearance of 20 feet above ground level. (Assumptions should include 150-foot long spans).*

Element	Quantity
Foundations	3
Piers/Bents	3
Beams	3
Emergency Walkway and Parapet	900 Ft.
Vehicle/Train Running Surfaces	900 Ft.
Guidance and Retention Devices	1,800 Ft.

14. *Please provide information regarding actual costs of your vehicles and equipment for similar transit systems recently built or in revenue service.*

- *Are there any unique costs or proprietary technology considerations associated with your technology (positive or negative)? Please explain:*

  The proposed IHI technology is built upon decades of proven transit system technology development experience. IHI's proven capabilities as a system integrator have been able to maximize the use of off the shelf components and technological system open architecture. In fact, it is this design focused upon standardized open architecture concepts which enable IHI to offer a distinct advantage relative to other steel wheel/steel rail and rubber tired solutions.

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- *Please tell us if your system would reduce the costs associated with right-of-way acquisition and/or reduce the impacts to traffic and the community when compared to an elevated 28 foot wide guideway built on single piers at approximately 150 foot spacing. Please explain:*

  IHI would like to work closely with the City to further explore methods of reducing the necessary system footprint and corresponding impacts.

III – TECHNOLOGICAL MATURITY

15. *Has your proposed transit system been proven in revenue service for at least five years? Please provide information and local contacts regarding some of those locations.*

All major Automated Train System elements (vehicles, power distribution, guidance and switching, station equipment, and driverless train control system) have been fully and successfully supplied and/or integrated by IHI exceeding customer expectations for several projects. Figure: 'Successful IHI Transit Development History' defines the various proven features of the IHI technology which have become the genesis of the present transit system offering.

Figure: Successful IHI Transit Development History

Project Name	Performance Standards			
	Year in Revenue Service	System Capacity (pphpd)	Operational Headway (seconds)	Platform Length (ft)
Osaka Newtram	1981	12,600	135	105
Kanazawa Seaside Line	1989	7,500	180	138
Kansai International Airport Wing Shuttle	1994	29,160	120	92
Tokyo Waterfront New Transit Yurikamome	1995	7,500	120	177
Osaka Techno Port Line (Osaka Newtram Extension)	1997	12,600	135	105
Taipei Chiang Kai-Shek International Airport	1997	N: 2,000 S: 4,000	120	66

Project Name	Local Contact Information
Osaka Newtram	Tsuneo Katsuno, Construction Technology Manager Osaka Municipal Transportation Bureau, Tel: +81-6-6582-1101
Kanazawa Seaside Line	Yasuo Miyaki, Managing Director Yokohama New Transit Co. Ltd., Tel: +81-45-787-7000
Kansai International Airport Wing Shuttle	Yutaka Usui, Director of Maintenance Department Kansai International Airport Co. Ltd., Tel: +81-724-55-2245
Tokyo Waterfront New Transit Yurikamome	Tadao Nishizawa, Technical General Manager Yurikamome Inc., Tel: +81-3-3529-7777
Osaka Techno Port Line (Osaka Newtram Extension)	Tsuneo Katsuno, Construction Technology Manager Osaka Municipal Transportation Bureau, Tel: +81-6-6582-1101
Taipei Chiang Kai-Shek International Airport	Mao-Shiung Lee, Manager Civil Aeronautic Administration, Tel: +886-2-2349-6302

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16. *Please provide the status of any regulatory approvals required or pending.*

No regulatory approvals are either required or pending for any current or upcoming IHI project.

17. *Please describe to what extent your technology uses proven and recognized off-the-shelf components and sub-components, which have been used in transit applications with similar levels of performance and reliability.*

The following discussion provides an overview of the technical maturity and evolutionary path of various IHI operating system elements.

- ***Power Distribution System***

IHI has designed and supplied both DC and AC power distribution systems for several applications in a variety of operating system environments. For the City, IHI will provide an industry standard and proven DC power distribution system.

In addition to IHI's proven record of designing and supplying service proven power distribution systems, IHI will be supported by local contractors with extensive experience in Hawaii and the mainland U.S. with power distributions systems.

- ***Guidance and Switching System***

IHI is regarded as the 'original' provider and technology developer of the innovative side-guided APM technology which is now common throughout Japan and several Asian countries. This technology has also become the standard rubber tired APM design benchmark for all other supplier provided systems in Japan.

- ***Station Equipment***

In order to secure passengers' safety and maintain HVAC efficiency, platform screen doors and fully enclosed screens will be installed on the threshold between platforms and trains (see Appendix: 'Platform Screen Door Arrangement' for details). In addition, IHI will provide intelligent passenger information and CCTV systems. IHI has extensive experience designing and integrating all of these technologies into its operating system. IHI will evaluate several U.S. manufactured station equipment technologies (based on technical features, ability to meet performance requirements, relevant supply record and references, costs, and parts supply network) and select the most appropriate for the City.

- ***Driverless Train Control System***

The IHI driverless train control system has been successfully designed and installed in passenger service for several transit applications (as well as other applications) which are substantially similar to Honolulu.

The majority of direct IHI train control integration experience has been focused upon industry standard fixed block technologies as provided by most leading train control suppliers. IHI has amassed a considerable amount of experience with these complex subsystem technologies. The integrated logic block CBTC system is considered a technological improvement to fixed block technologies. The CBTC system provides additional operational flexibility to enhance passenger capacity and is becoming the industry standard method of train control for APM and other rail applications.

IHI is highly confident that its expertise and experience designing, integrating and installing transit systems will result in a highly efficient and reliable train control system to benefit the City.

18. *Please describe the status of the engineering and detailed design of your transit system and identify any technology risks.*

IHI, through its own extensive industrial background including the acquisition of Niigata transit technology, knows how to develop and implement technology which leverages existing expertise while expanding the innovation envelope. While technology maturity is critical to obtaining refined and optimized system reliability, the IHI view of technology maturity is based upon proven product evolution and sound engineering principles. In particular, IHI focuses on guaranteeing that the technology offered incorporates refined and optimized proven system reliability and maturity (through testing, analysis, simulation, detailed evaluation of subsystems prior to integration, and a highly conservative design approach).

This transit technology program for the City will require the full integration of designers, constructors, installers, operators, and maintainers to work together throughout the life of the system to develop a system which is cost effective, reliable, maintainable, and durable. Proposed IHI system vehicles, power distribution, guidance, station equipment, train control, and other vital subsystems must be installed and function in full agreement and as designed. Both effective processes (interfaces, subcontractor management, other) and staff talent will be required to ensure that the system performance of the proposed system is achieved to the satisfaction of the City and the riding public.

IHI has demonstrated its ability to perform these functions through developing several successful transit system installations including those for Taipei Chiang Kai-Shek International Airport, Tokyo Waterfront New Transit Yurikamome, Kansai International Airport, and several others. These programs included the complete integration of vehicle, power distribution, guidance, station equipment, and train control subsystems - including those of major subsystem suppliers other than IHI (such as for train control).

All IHI programs (to date) have contributed to the collective IHI system integration capability. A few of the applicable 'lessons learned' from other programs as will be applied to the Honolulu program include:

- Thorough customer training significantly improves system acceptance and operational understanding;
- A detailed design in advance significantly accelerates the implementation process;
- Physical on-site conditions must be thoroughly evaluated early in the design/implementation process;
- Customer staff must be involved as early in the overall project program as possible;
- Interfaces and integration with existing airport systems must be planned for in thorough detail;

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- Processes for configuration management and problem reporting must be in place early in the overall program;
- Other.

The IHI vehicle system for the City represents an update and enhancement of the successful IHI vehicle concept as applied to the other transit programs cited within the IHI experience table (as noted above). These enhancements are further based upon IHI's extensive vehicle development history in the automated people mover (APM) and railway industries. The most notable enhancement to the fully mature, service proven IHI base vehicle technology is the integration of advanced composite materials for the vehicle carbody.

The applied composite technology embodies and utilizes the latest in proven advanced materials engineering as applied to railway and aerospace applications. It features significant weight reduction potential (in comparison with traditional metallic structures) and enables proven safety and styling advantages. Critical material testing and analyses (i.e. NFPA 130 material testing, structural, fatigue, and impact analyses) for this application have already been successfully completed to validate the high performance attributes of the APM carbody.

19. How do you typically guarantee the long term availability of replacement vehicles, systems equipment, and spare parts, as well as software support?

The IHI approach to long term availability of replacement system elements includes a design approach which maximizes off the shelf components, open architecture, and industry proven methods. The long term availability of replacement elements is further insured by IHI's long and stable history as a designer, developer, system integrator, and engineering leader. IHI is in the transit industry to stay.

INFORMATION PACKAGE

VEHICLE CHARACTERISTICS QUESTIONNAIRE

1. **General:**

• Electric propulsion:	YES __X__ NO ____
• High floor:	YES __X__ NO ____
• Fully automatic train operation (manual back-up)	YES __X__ NO ____
• Bi-directional vehicles:	YES __X__ NO ____
• Third rail or equivalent current collection:	YES __X__ NO ____
• Dynamic braking:	YES __X__ NO ____
• Regenerative braking:	YES __X__ NO ____
• ADA compliant:	YES __X__ NO ____
• Level boarding:	YES __X__ NO ____
• Crash worthiness compliant:	YES __X__ NO ____
• Crash worthiness details provided:	YES __X__ NO ____
• Fire performance to NFPA 130:	YES __X__ NO ____
• Emergency evacuation provisions:	YES __X__ NO ____
• Video monitoring and recording:	YES __X__ NO ____
• Automatic vehicle location / VMS system:	YES __X__ NO ____
• Vehicle life:	__25__ years minimum
• Details of noise mitigation measures provided:	YES __X__ NO ____
• Vehicle maintenance and diagnostic system:	YES __X__ NO ____
• High reliability / availability:	____ mean time between train delays
• Low mean time to repair:	____ mean time to repair
• Expected vehicle life:	__25__ years minimum
• Automatic passenger counting system:	YES __X__ NO ____
• Vehicle general arrangement drawings provided:	YES __X__ NO ____
• Vehicle cross sections provided:	YES __X__ NO ____
• Vehicle to guideway interface details provided:	YES __X__ NO ____
• Vehicle static clearance envelope provided:	YES __X__ NO ____
• Vehicle dynamic clearance envelope provided:	YES __X__ NO ____
• Vehicle length (over ends of vehicle):	__39.3__ ft.
• Vehicle length (over extended couplers):	__40.2__ ft.
• Vehicle width (maximum carbody):	__9.3__ ft.

- Vehicle width (over door threshold): 9.3 ft.
- Vehicle height (maximum): 12.1 ft.
- Maximum weight per vehicle (empty): ______ lbs.
- Ergonomic design as specified: YES X NO ______

2. **Performance:**

- Maximum operating speed: 55 mph
- Maximum acceleration rate: 3 mphps
- Service braking rate: 3 mphps
- Emergency braking rate: ______ mphps
- Minimum horizontal radius curve: 131 ft.
- Minimum vertical radius curve: 820 ft., crest 820 ft., sag
- Maximum grade: 7 % for any ft.
- Maximum sustained grade: 7 %

3. **Passenger Accommodations:**

- # of wheelchair spaces: 2 spaces
- Number of seats per car: 28 seats (tip-up seats may be included)
- Number of standees per car at design load of 4 passengers / m² (AW2): 52 standees
- Total number of passengers per car (seated + standees) at AW2 design load: 80 total passengers
- Air conditioned: YES X NO ______
- PA system with auto-announcer: YES X NO ______
- Passenger to OCC communications: YES X NO ______
- Destination and passenger information displays: YES X NO ______

4. **Train Sets:**

- Capable of coupling to make multicar trains: YES X NO ______
- Capable of failed train retrieval: YES X NO ______
- Capable of bidirectional operation from each car: YES X NO ______

INFORMATION PACKAGE

SYSTEM CHARACTERISTICS QUESTIONNAIRE

1. Superelevation Limits

What are the superelevation requirements of your system?

Please explain:
A maximum 7% superelevation will be implemented at each curve section as shown in Appendix: 'Dual Lane Curve Guideway Cross Section'.

2. Route Geometric Constraints

Does your system meet the following criteria?

- Minimum horizontal radii:
  - Maintenance Facility: 150 ft.;
  - Elevated Structure: 400 ft.
- Minimum horizontal lengths:
  - Curves: 100 ft.;
  - Tangents: 100 ft.;
  - Spirals: 100 ft.
- Vertical alignment:
  - Maximum station grade: 1%;

YES ___X___ NO _______

If not, please explain:

3. Hours of Operation:

Does your system meet the following?

- 4:00 a.m. to 12:00 a.m. service day;
- 6:00 a.m. to 9:00 a.m. morning peak;
- 3:00 p.m. to 6:00 p.m. evening peak.

YES ___X___ NO _______

4. **Station Dimensions:**
   - Platform length: 300 ft. maximum; with all doors on platform?

YES ___X___ NO _______

If not, please explain:

____

____

5. **Emergency Evacuation Walkways:**

Does your system meet all of the following criteria?

- Must be along entire guideway;
- Must be accessible from vehicle;
- Minimum evacuation walkway width: 2'–6";
- Minimum evacuation walkway height: 6'–8";
- Minimum maintenance walkway width: 2'–0";
- Minimum maintenance walkway height: 6'–8";
- Walkway width is clear of the vehicle dynamic envelope;
- Walkway around switches meet state and local requirements.

YES ___X___ NO _______

If not, please explain:

____

____

6. **Traction Power:**
   - Power: Please provide Voltage and Distribution Configuration;
   - Substation spacing ___5280___ ft.;
   - Substation size: ___2___ MW.

Voltage will be 750 VDC for traction power. A medium voltage AC distribution system will be employed for infrastructure needs (station power etc.).

7. **Train Control / Signal System:**

   Can your system be supplied with a bi-directional fully automatic train operation with manual back-up?

   YES __X__ NO ______

   If not, please explain:

   ____

   ____

   Please provide examples of existing installations in revenue service:

   Please see the Technology Characteristics Questionnaire, Section III – Technological Maturity, Question 15 for details of existing installations in revenue service.

8. **Communications:**

   - Radio system: YES __X__ NO ______
   - Passenger communication system to OCC/ Operators: YES __X__ NO ______
   - On-board Closed Circuit Television: YES __X__ NO ______
   - Fire & emergency management system: YES __X__ NO ______
   - On-board ADA message system: YES __X__ NO ______

9. **Noise and Vibration:**

   - Can your system meet or exceed the levels and criteria as established by the FTA *Transit Noise and Vibration Impact Assessment Guidance Manual* and the goal of 75 dBA at stations?

     YES __X__ NO ______

   Please explain how this is achieved:

   IHI's side guidance system and proprietary surface grinding machine technology for the reinforced concrete running surfaces reduces vibration and noise considerably.

   If not, please explain:

   ____

   ____

   - What noise level is achieved from your system operating on elevated guideway at 55 mph, measured 50 feet from the guideway centerline?

     __**74**__ dBA

Cite a location where such a level can be measured:

Kanazawa Seaside Line (see the Technology Characteristics Questionnaire, Section III – Technological Maturity, Question 15 for details)

10. Other Characteristics:

Does your system provide the following?

- Fully accessible and meets all ADA requirements, including the regulatory requirements of 49 CFR Part 38, Transportation for Individuals with Disabilities;
- Meets all Buy America requirements; and
- Cost-effective to operate and maintain.

YES __X__ NO ____

If not, please explain:

Please explain how cost-effectiveness is achieved:

The use of vehicle composite materials will result in lower energy costs and overall life cycle cost by reducing overall vehicle weight.

Information Marked Proprietary

Information not supplied

Mitsubishi/Itochu

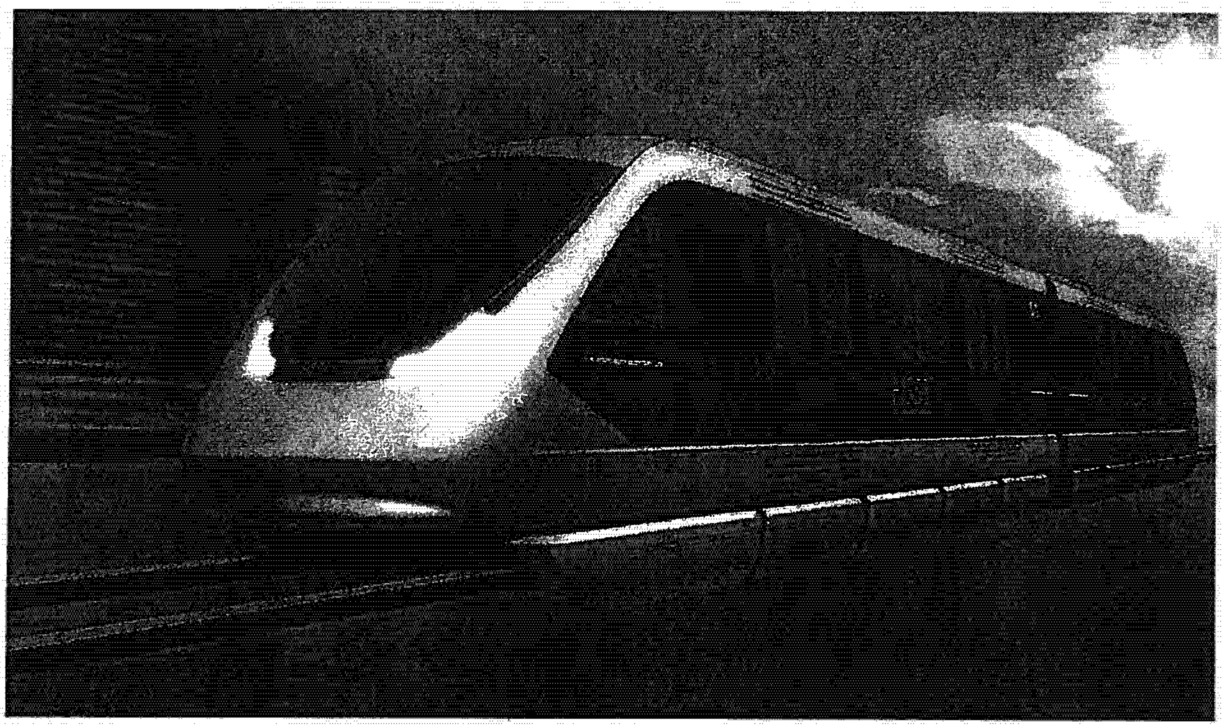
INFORMATION PACKAGE

SYSTEM CHARACTERISTICS QUESTIONNAIRE
NOTICE TO FIXED GUIDEWAY SYSTEM VEHICLE SUPPLIERS

REQUEST FOR INFORMATION

(RFI 001)

HSST (High Speed Surface Transport) SYSTEM



Prepared by

Mitsubishi Heavy Industries America, Inc
And
ITOCHU International Inc.

MITSUBISHI
HEAVY INDUSTRIES AMERICA, INC

ITOCHU

January 24, 2008

Sent via internet to: transitmailbox@honolulu.gov
MS. MARY PATRICIA WATERHOUSE
Director of Purchasing
Department of Budget and Fiscal Services
530 South King Street, Room 115
City Hall
Honolulu, Hawaii 96813

Subject: RFI 001 Honolulu High Capacity Transit Corridor Project

Dear Ms. Waterhouse:

Mitsubishi Heavy Industries America, Inc. and ITOCHU International Inc. are pleased to submit this response to the Request for Information for the Honolulu High Capacity Transit Corridor Project. We are proposing our HSST (High Speed Surface Transport) Maglev technology, which we believe will provide significant benefits to residents of the City and County of Honolulu for the HHCTC project.

The team of ITOCHU and Mitsubishi provide unmatched financial strength and a fully proven transit technology. Mitsubishi has over 30 years of experience in the transit industry, with an unmatched record of delivering all projects on time and with no safety incidents.

During our presentations and visits to Honolulu we have found many enthusiastic supporters interested in seeing the Maglev technology competitively evaluated and considered for the fixed guideway transit technology for this important transit system. The levels of performance and reliability provided by the HSST are superior to all other technologies being considered for this project.

The HSST system is fast, aesthetically attractive, and environmentally friendly, providing an efficient means of transportation for Honolulu's residents and visitors, and would become a tourist attraction in its own right. As the vehicles are silently levitated above the guideway, they provide a very quiet, smooth and comfortable ride unmatched by any other technology. The slim guideway design and quiet operation would allow for a much more flexible alignment as the system could operate in close proximity to commercial and residential

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INFORMATION PACKAGE

TECHNOLOGY CHARACTERISTICS QUESTIONNAIRE

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MITSUBISHI
HEAVY INDUSTRIES AMERICA, INC

PROPOSAL
FOR
INFORMATION PACKAGE
SYSTEM CHARACTERISTICS QUESTIONNAIRE
NOTICE TO FIXED GUIDEWAY SYSTEM VEHICLE SUPPLIERS

REQUEST FOR INFORMATION
(RFI 001)

LIGHT RAIL TRANSIT SYSTEM

This document contains confidential and proprietary information. Its use or disclosure is not permitted without prior approval by Mitsubishi Heavy Industries America, Inc

Information Marked Proprietary

Information not supplied

MITSUBISHI
HEAVY INDUSTRIES AMERICA, INC

Sumitomo

January 24, 2008

Sent via internet to: transitmailbox@honolulu.gov
MS. MARY PATRICIA WATERHOUSE
Director of Purchasing
Department of Budget and Fiscal Services
530 South King Street, Room 115
City Hall
Honolulu, Hawaii 96813

Subject: RFI 001 Honolulu High Capacity Transit Corridor Project

Dear Ms. Waterhouse:

Mitsubishi Heavy Industries America, Inc. and Sumitomo Corporation of America are pleased to submit this response to the Request for Information for the Honolulu High Capacity Transit Corridor Project. We are proposing our LRT technology, which we believe will provide significant benefits to the City, County, and residents of Honolulu for the HHCTC project.

The team of Mitsubishi and Sumitomo provide unmatched financial strength and a fully proven transit technology. The companies have over 30 years of experience in the transit industry, with an unmatched record of delivering all projects on time and with no safety incidents. We have successfully delivered, operated, and maintained many commuter rail, light rail, monorail, and automated people systems throughout the world, and are currently working on numerous projects throughout the United States including in Georgia, Florida, and Washington D.C.

The proposed technology is the same LRT system that is being provided for the Dubai Metro project which, when completed, will be the longest fully automated, driverless public transit system in the world. Our team brings tremendous experience in the construction of fully automated, driverless systems in a wide range of environments across the globe. We have demonstrated expertise in system integration and project management of "mega" transit systems, such as most recently the Taiwan High Speed Railway and Dubai Metro systems.

In addition to the project implementation strength offered by our team, the proposed system also provides high levels of performance and reliability utilizing fully service proven technologies. This includes the state-of-the-art Communications Based Train Control system, and Integrated SCADA communications system.

Please let us know if any further information is required at this time. We look forward to presenting our system to the City and your expert staff, and working together to realize this exciting project.

Sincerely Yours,

T. Yamamoto

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MITSUBISHI
HEAVY INDUSTRIES AMERICA, INC

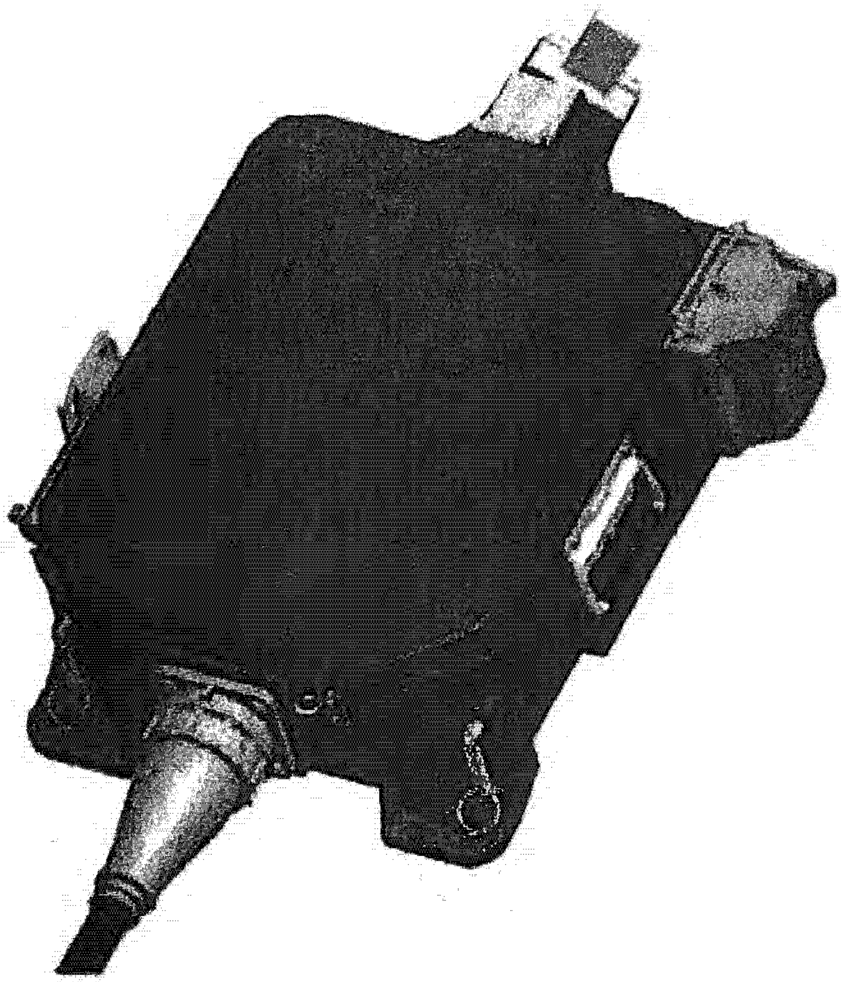
PROPOSAL
FOR
INFORMATION PACKAGE
SYSTEM CHARACTERISTICS QUESTIONNAIRE
NOTICE TO FIXED GUIDEWAY SYSTEM VEHICLE SUPPLIERS

REQUEST FOR INFORMATION
(RFI 001)

ATTACHMENT

ATTACHMENT 10

vossloh
Switch Systems



TECHNICAL MANUAL

MCEM91-22 POINT MACHINE

Document No. 1010-800-078 REV 0 Date 08/12/2006

This document is non contractual and may be modified without prior notice

CONTENTS

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1. PRESENTATION

The MCEM 91 Point Machine can be used on all kinds of tracks, from service tracks to high speed tracks. The point machine is versatile with its capacity to be used on point, heel or at swing nose with one ore more back drives.

The point machine provides a complete solution to point actuation (actuation, application and detection). It also provides strong resistance to severe environmental conditions.

The Point Machine is certified with French Standard NF F 52-152 (operation of points).

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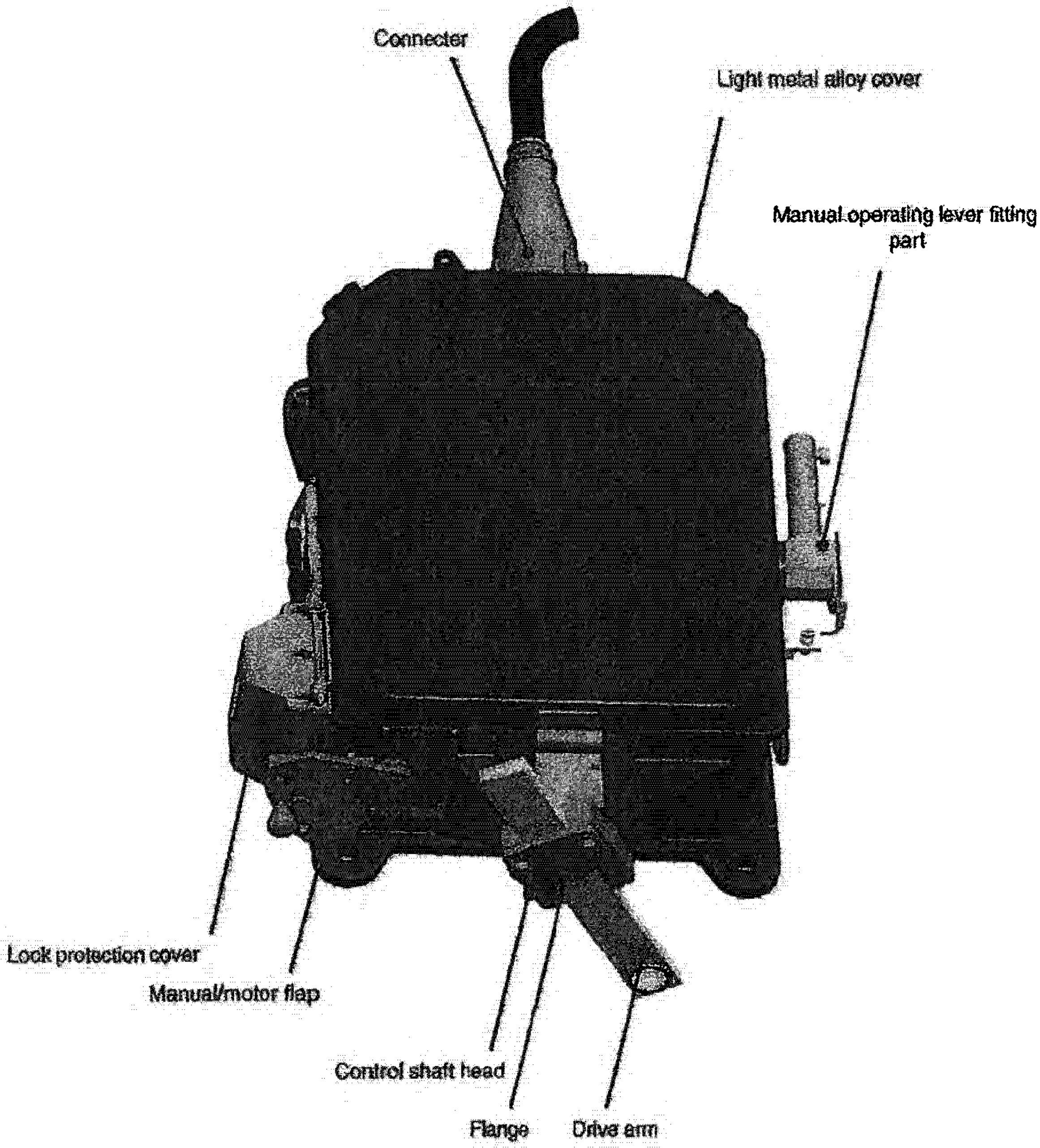
2. DESCRIPTION

2.1 EXTERIOR VIEW



2.2 INTERIOR VIEW

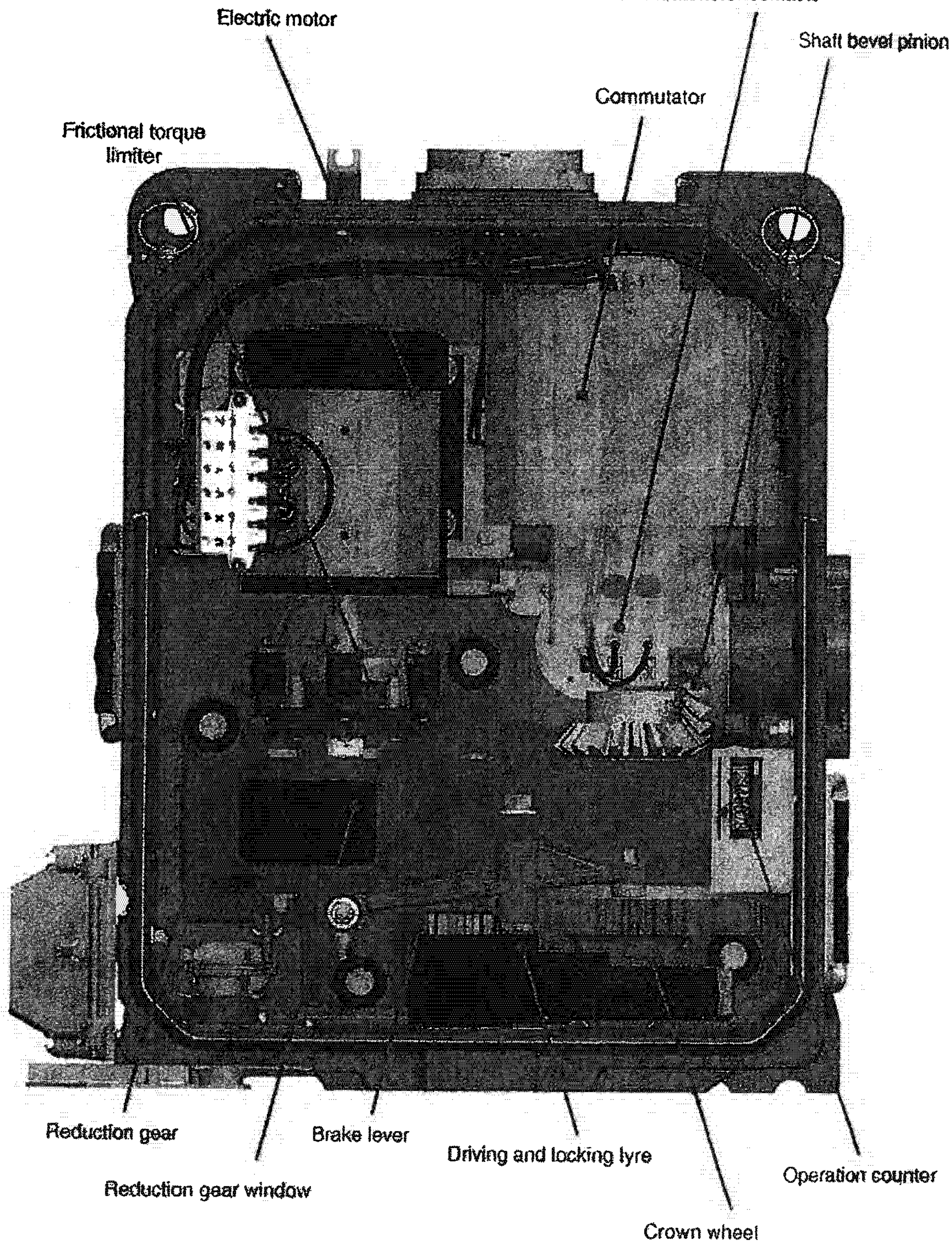


Figure 2.1 (a) : Interior view

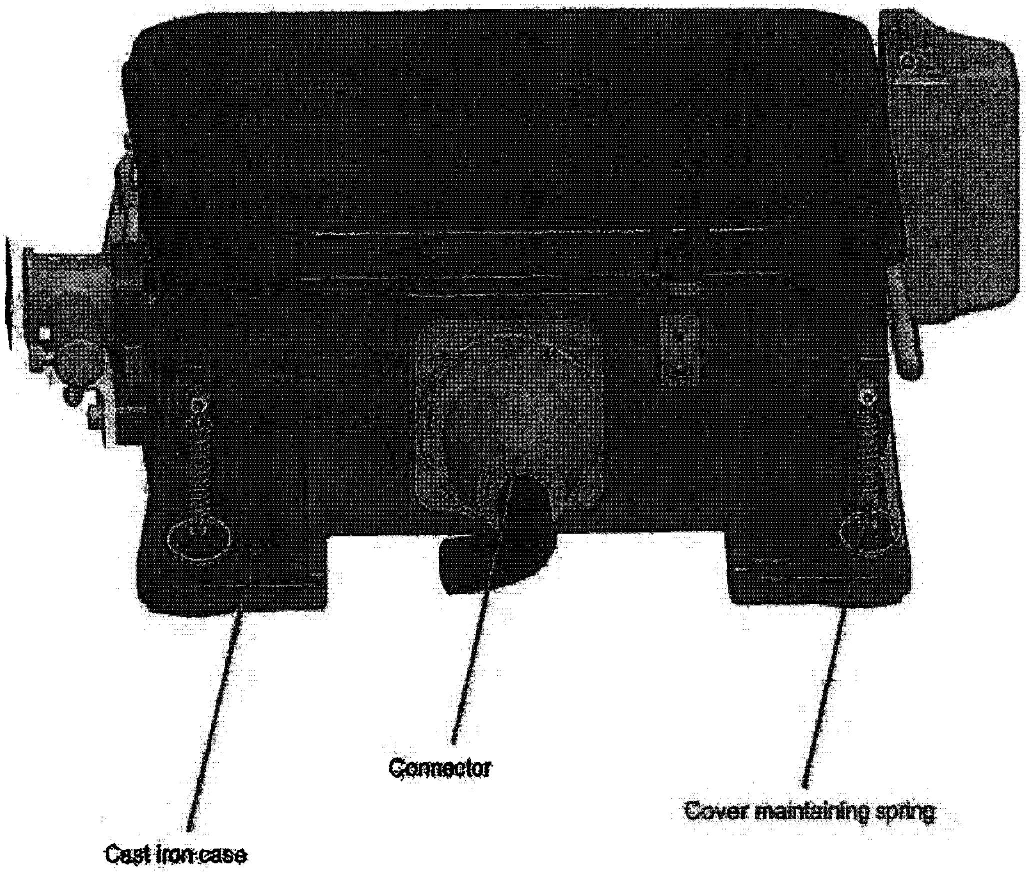


Figure 2.1 (b) : The closed machine

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3. OPERATION

The electric motor drives the frictional torque limiter through the elastic coupling. The frictional torque limiter gives the input to the Gear reduction box.

The movement from one extreme position to the other is done in three steps :

Step 1: Exit from the locking area

During the rotation of the crown-wheel, attached to the output shaft of the reduction gear, the roller engaged in the lyre runs a stroke of 26° in the recess of the lyre without driving this lyre.

Step 2: Rotation of the control shaft

By continuing its rotation, the roller, attached to the crown-wheel, drives the lyre, which is going to drive the control shaft head and its arm on a total circular stroke of 60°.

Step 3: Entering the locking area, and lock setting

When the lyre arrives at end stroke, the crown-wheel and the roller continue to turn on a 26° stroke.
The crown-wheel stops rotating when its stop comes into contact with the lyre. Then the roller is in the bottom of the lyre's recess.
So the crown-wheel has preformed a total rotation of 256°.

3.1 LOCKING

The Point machine provides locking of the switches in its end positions. This is done to avoid any unintentional movement.
When the stop of the crown-wheel is touching the lyre, the driving roller is in the bottom of the lyre's recess. If the control arm is operated in a way that tends to bring the system back to the opposite position, the lyre meets the roller. The two circular locking areas having a stroke of 26° each are provided with this locking system.

3.2 BRAKING – ANTI-VEERING

At the end of the stroke, braking is provided by a mechanical component designed to prevent :

- Bouncing back of the components that can potentially cut off the locking and control contacts.
- Veering of the machine probable under high vibration.

AR00085511

When the crown-wheel gets to 15° before the end of its stroke, the brake lever roller that follows the cam of the crown-wheel lifts the brake lever and puts in contact the brake pad and the driving shaft.
A spring pressure provides the braking strength of the pad on the shaft.

Figure 3.2 : Anti-Veering device

3.3 FRICTIONAL TORQUE LIMITER

The MCEM 91 Point Machine is equipped with a frictional torque limiter (see photo below) in order to :

- Absorb the kinetic energy of the rotation parts at the end of the stroke after the motor is cut off.
- Prevent the machine from any damage due to motor strain.
- Allow the slow transformation of rotational energy to potential energy of the motor when the switch blade arrives at the end position

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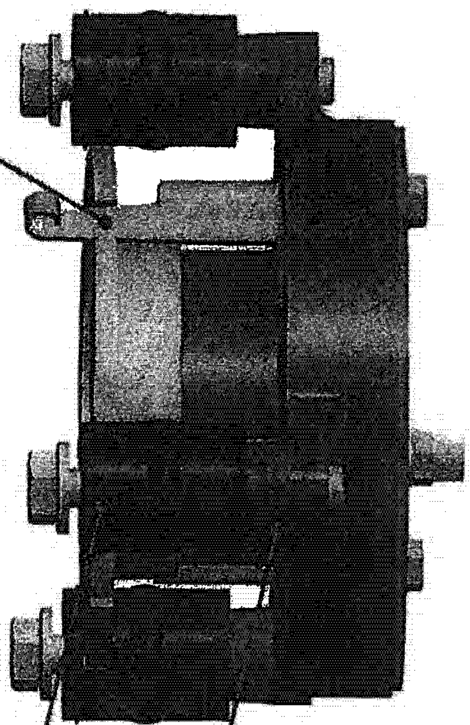

Figure 3.3 : Frictional torque limiter

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3.4 MANUAL OPERATING LEVER

In case of power failure or during any emergency, point machine can be operated with a manual operating lever.

Bring the motor/manual flap to "Manual" position. This cuts the two phases of the power circuit of the machine, cuts the control circuit and engages the clutch in the bevel pinion. The point machine can then be operated manually. Operation is considered complete when the operating lever has performed 180° of rotation. Also the manual/motor lock can be immobilized by a padlock, or by the point lock placed under the lock protection cover.

4. POINT MACHINE CHARACTERISTICS

4.1 MECHANICAL DIMENSIONS

- Dimensions : (see annex 5.1)
- Weight : 95.5 Kg
- Adjustable stroke : 100 to 260 mm
- Maximum torque : 4000N for 260mm i.e. 1040N.m.
- Max .Maneuver time : 4.5s

4.2 ELECTRICAL CHRACTERISTICS

- Power supply : 3-Phase 400VAC .
- Connector : 24 pin
- Changeover switch : 4 motor control contacts
  4 limit contacts
  2 manual /motor contacts to cut the two phases
  2 contacts that cut off the detection circuit in Manual mode
- Electronic thermostat : IP65, 230VAC±10%
- Heater: IP 32, 230VAC, 13 W

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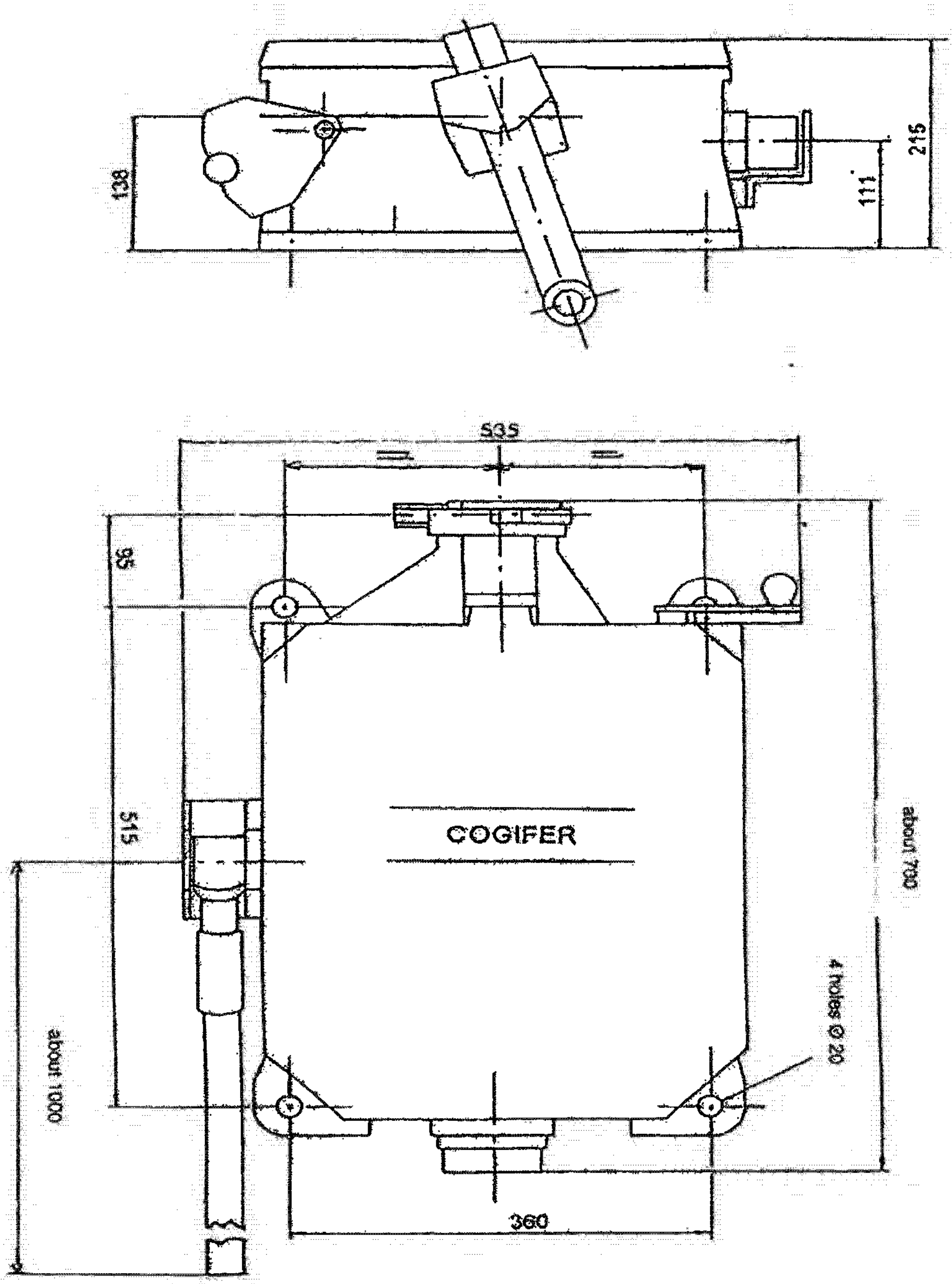
5. ANNEXES

5.1 DIMENSIONS



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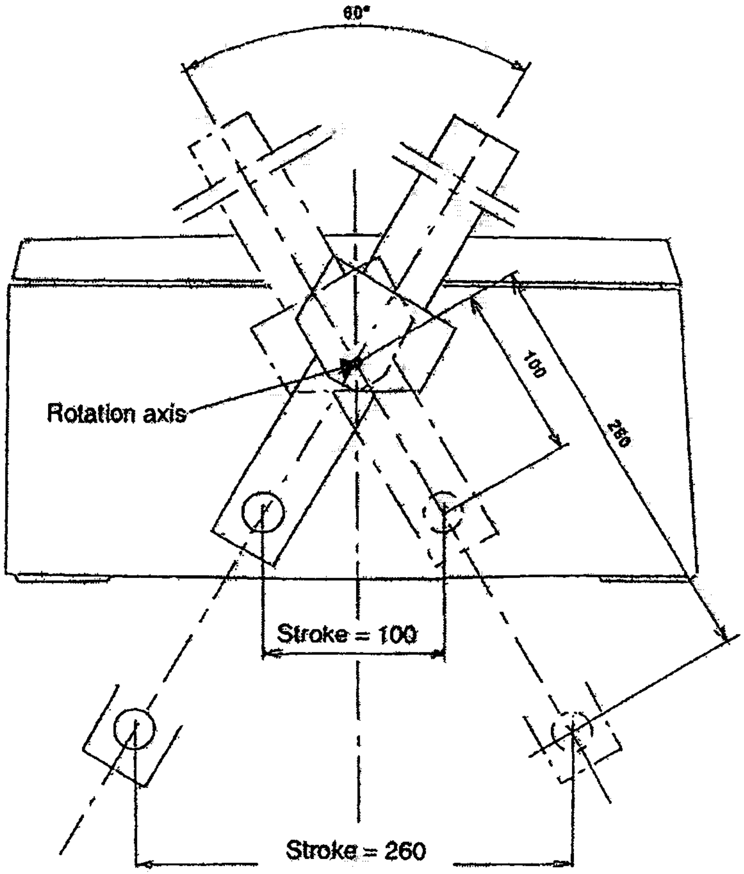
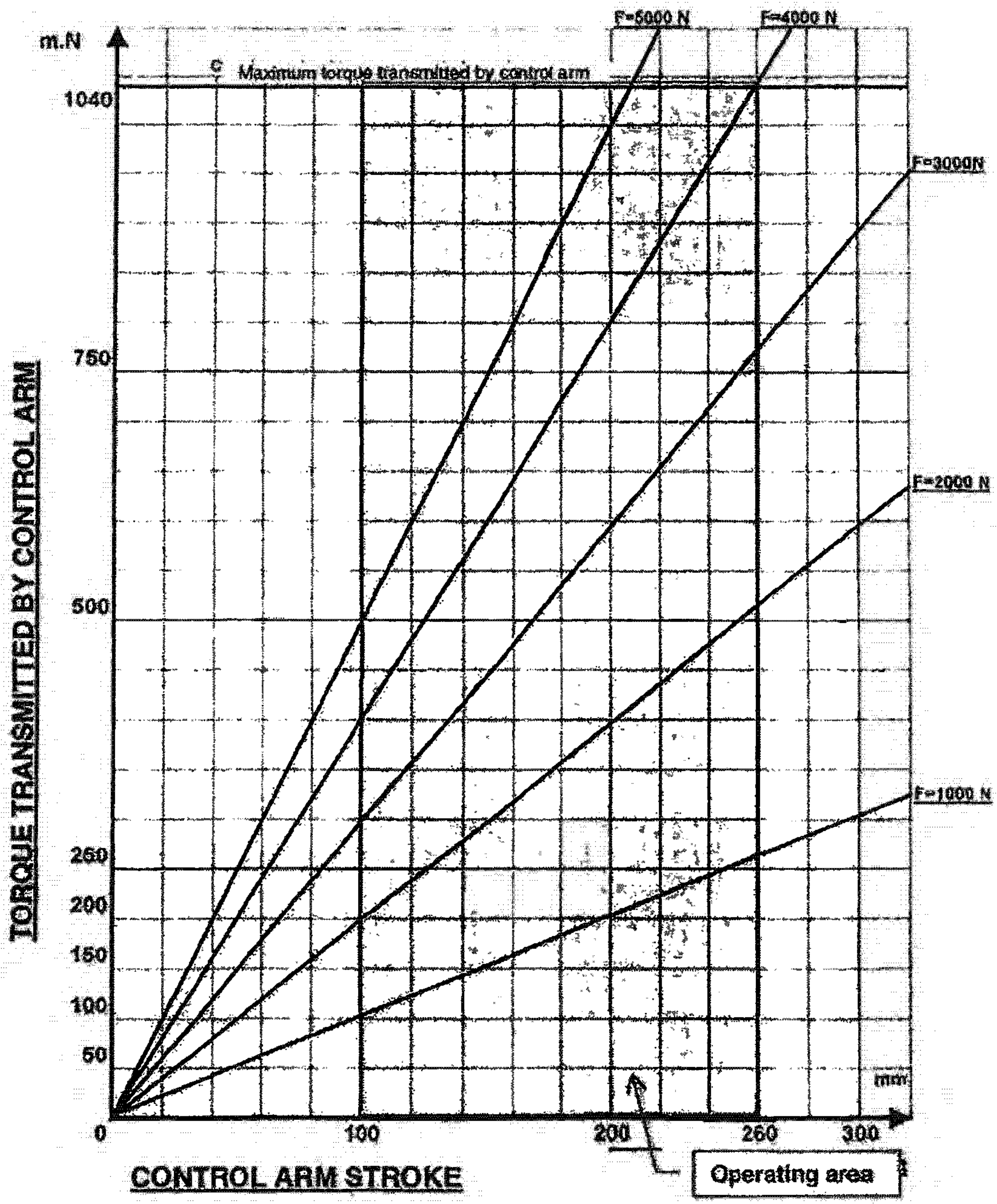
5.2 STROKE SETTING



Stroke can be set in the range of 100 to 260 mm, by simply sliding the control arm along the groove cut in the control shaft head. The total circular stroke of the control arm is 60°. The stroke applied to the switch will be equal to the distance between the boring axis of the control arm and its rotation axis which is represented on the flange.

A flange screwed on the control shaft head makes the control arm to be held in the control shaft head.

5.3 STROKE –TORQUE DIAGRAM



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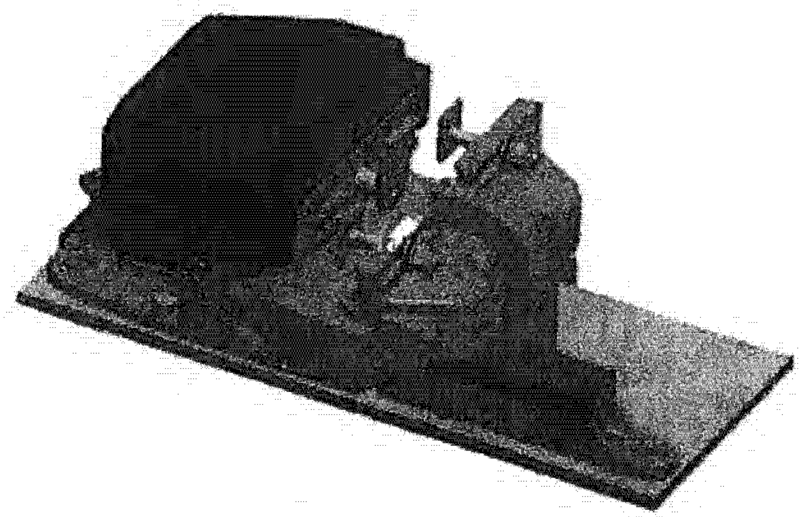
Switch Systems



TECHNICAL MANUAL

VCC CLAMP LOCK

Document No. 1010-100-014 REV 0 Date 08/12/2006

This document is non contractual, and may be modified without prior notice

CONTENTS

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1. INTRODUCTION

The V.C.C. Clamp Lock (an abbreviation for Verrou Carter Coussinet) is an individual switch locking safety device which immobilizes a point by direct action on the switch blades.

VCC Clamp Lock is installed at point. VCC ensures :
- the wedging of the open blade.
- the locking of the closed blade.

VCC clamp lock provides excellent security features. It is highly recommended for speeds more than 40 KMPH.

The VCC Clamp Lock compensates for the longitudinal thermal expansion of the switch blade without effect on its operation and safety.

1.1 REFERENCES

VCC Clamp Locks have full product approval with the French National Railways (SNCF), in accordance with the French Standards NF F 52-162 and NF F 52-164, and have been ensuring the safe operation of points on the French Network since 1929.

VCC Clamp Locks are used on :
- French High Speed Tracks (SNCF)
- Great Britain High Speed Tracks (CTRL- Channel Tunnel Rail Link)
- Belgian High Speed Tracks (SNCB)
- Korean High Speed Tracks (KTX)

The VCC Clamp Lock is also installed on other railway networks around the world including :
- Hong Kong Mass Transit : MTRC (Island Line) and KCRC
- Singapore Mass Transit : MRT
- Paris Mass transit : RATP
- Brussels Mass transit : STIB

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2. DESCRIPTION

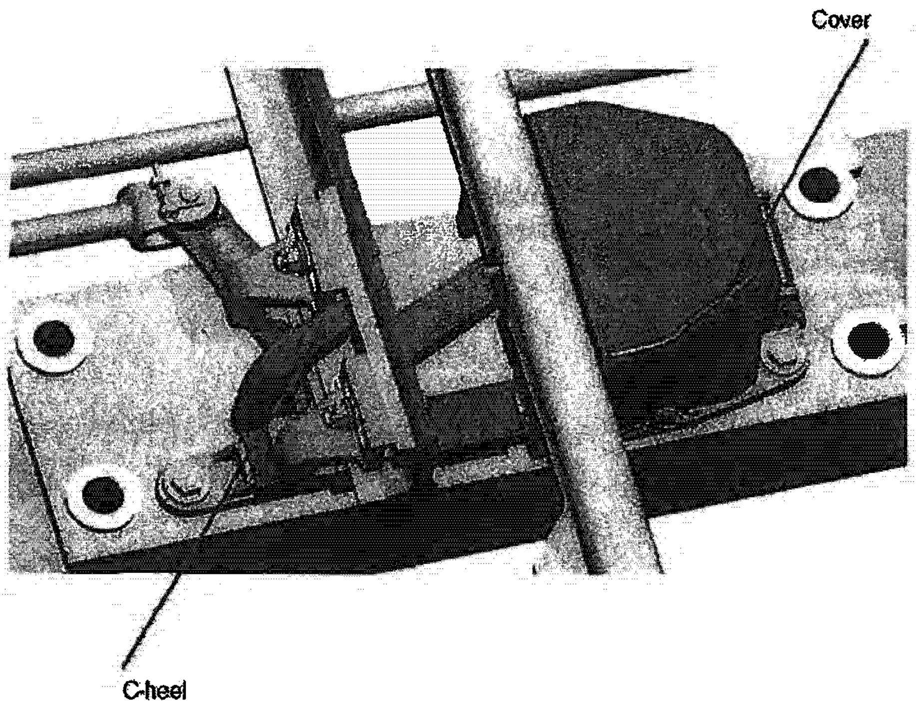
A VCC Clamp Lock is composed of the following components/sub-assemblies :

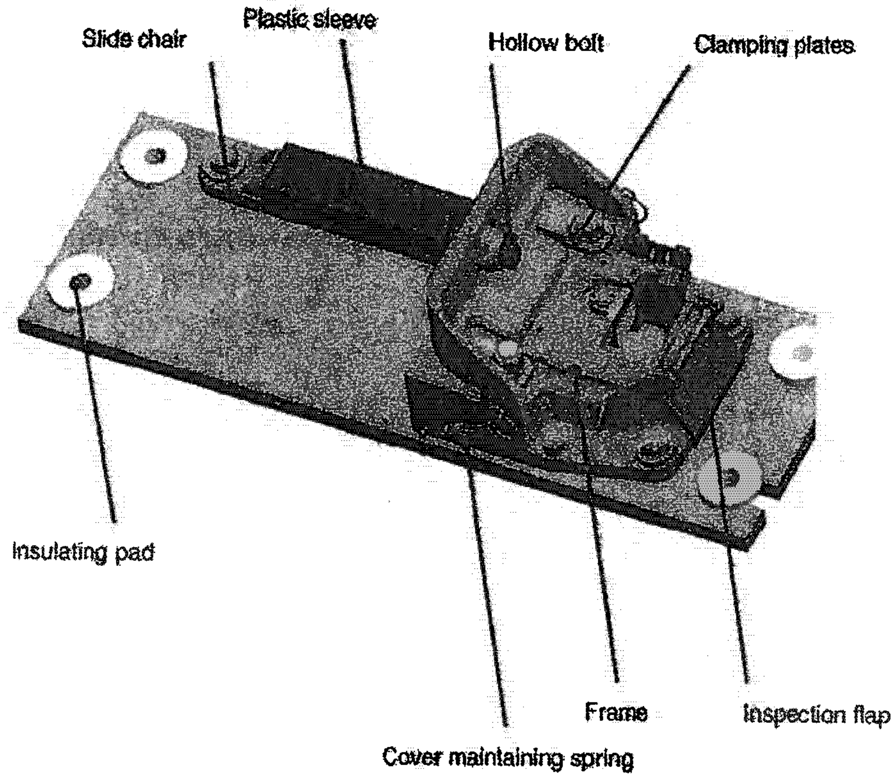
A. A frame and base plate assembly
B. A C-arm assembly

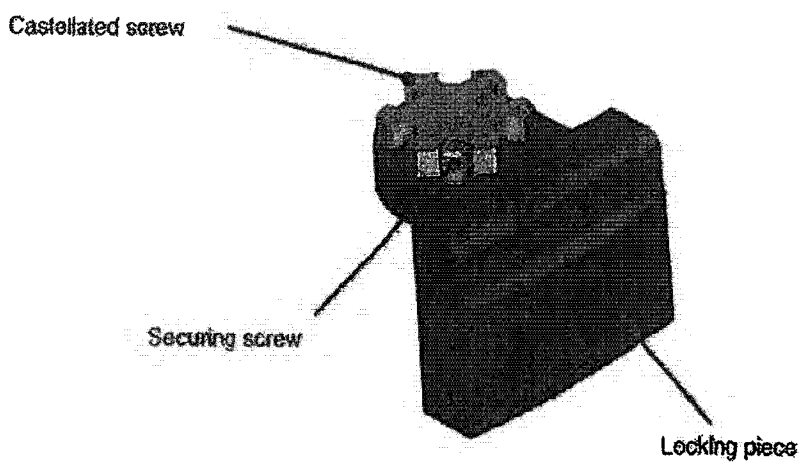
2.1. FRAME AND BASE PLATE ASSEMBLY

The main parts of this assembly are :

- a cast iron frame, with a support for the stock-rail
- a sliding plate (A Nickel-Chromium treated complete base plate can also be provided)
- a cast steel sliding plate with a plastic sleeve, which supports, through the fixing bracket, the blade during its travel
- a cast iron cover, fastened onto the frame with 2 spring clips
- a hollow bolt to fasten the frame to the stock rail and also for the passage of the VCC detector piston.



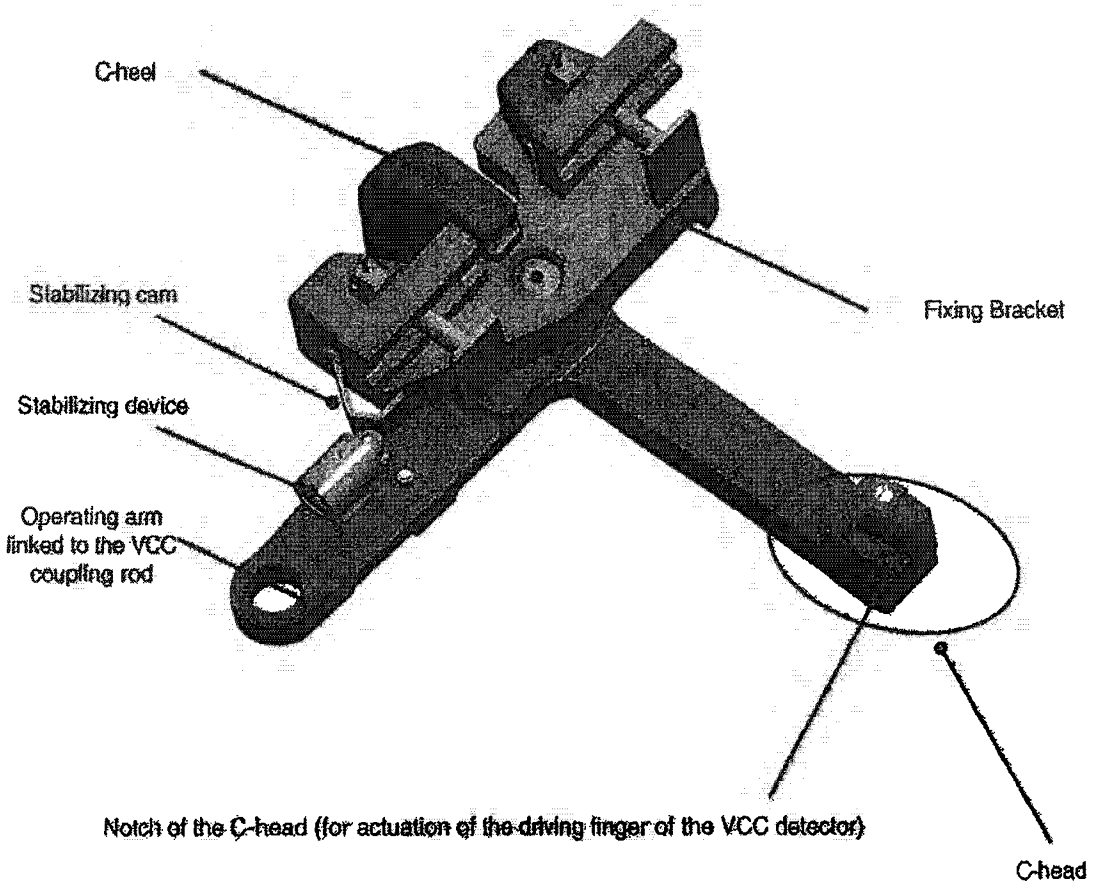

Slide chair
Plastic sleeve
Hollow bolt
Clamping plates
Insulating pad
Frame
Inspection flap
Cover maintaining spring


Castellated screw
Securing screw
Locking piece

2.2 THE C-ARM ASSEMBLY

The C-arm assembly is the moveable part of the VCC clamp lock. It consists of :

- a locking C-arm, linked to the VCC coupling rod through its operating arm
- a fixing bracket
- 2 hammer head bolts and spring washers assembly, for fastening the fixing bracket to the switch blade



The C-arm is attached to the fixing bracket with an axle which permits the rotation of the C-arm towards the fixing bracket.

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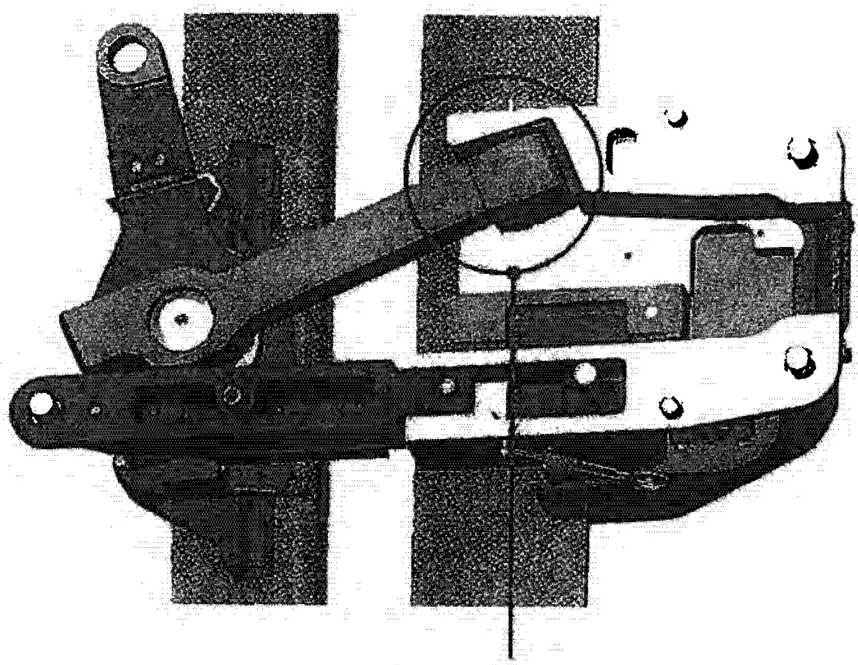
2.3 SAFETY

The VCC Clamp Lock is a positive direct locking device.
Both end of stroke positions of the VCC put each switch blade in an extremely safe position :

1- Wedging of the open blade

The wedging of the point open switch blade is achieved by the wedging chamber of the VCC frame.
When the blade is completely open, the C rotates so that the C-head enters this wedging chamber.
No external action can then close the blade because the C-head is pressed hard against the bottom of the chamber :

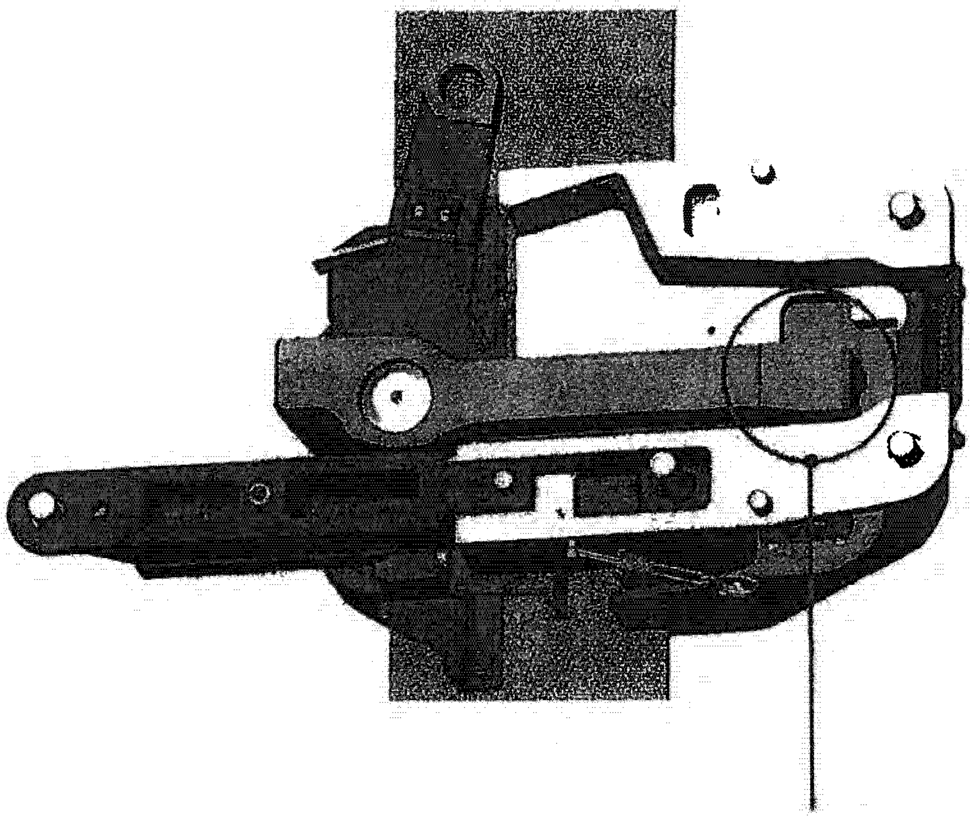


C-head in the wedging chamber
=
Wedging is achieved
=
SAFE POSITION

2- Locking of the closed blade

The locking of the closed blade of the point is achieved when the C-head is engaged behind the locking piece which is fitted to the VCG frame.

When the blade is applied against the stock rail, the C rotates so that the C-head overlaps the locking piece.
No external action on the switch rail can then open the blade because the C-head is pressed hard against the locking piece :



The C-head overlaps the locking piece (also see following pictures)

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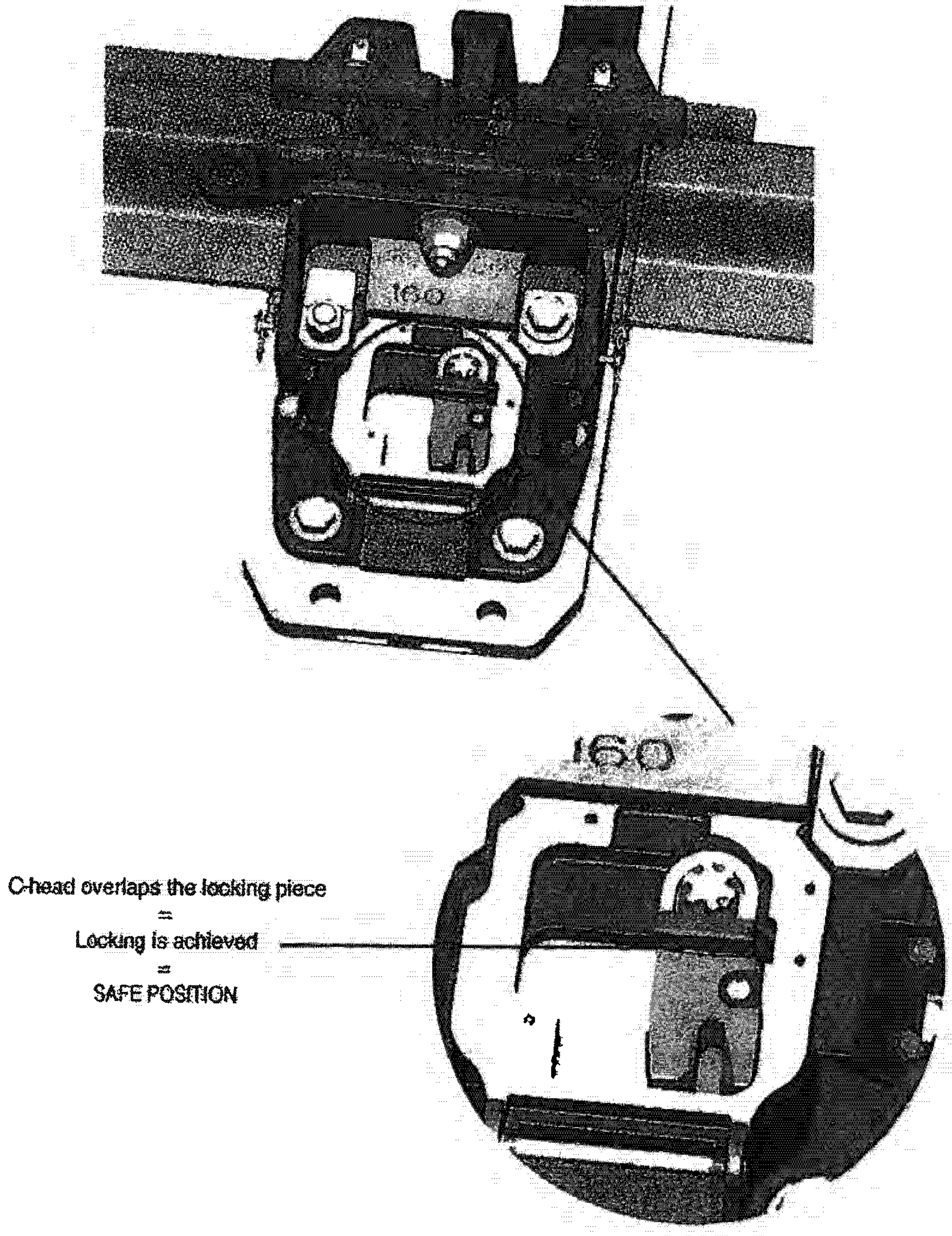
160
160
C-head overlaps the locking piece
=
Locking is achieved
=
SAFE POSITION

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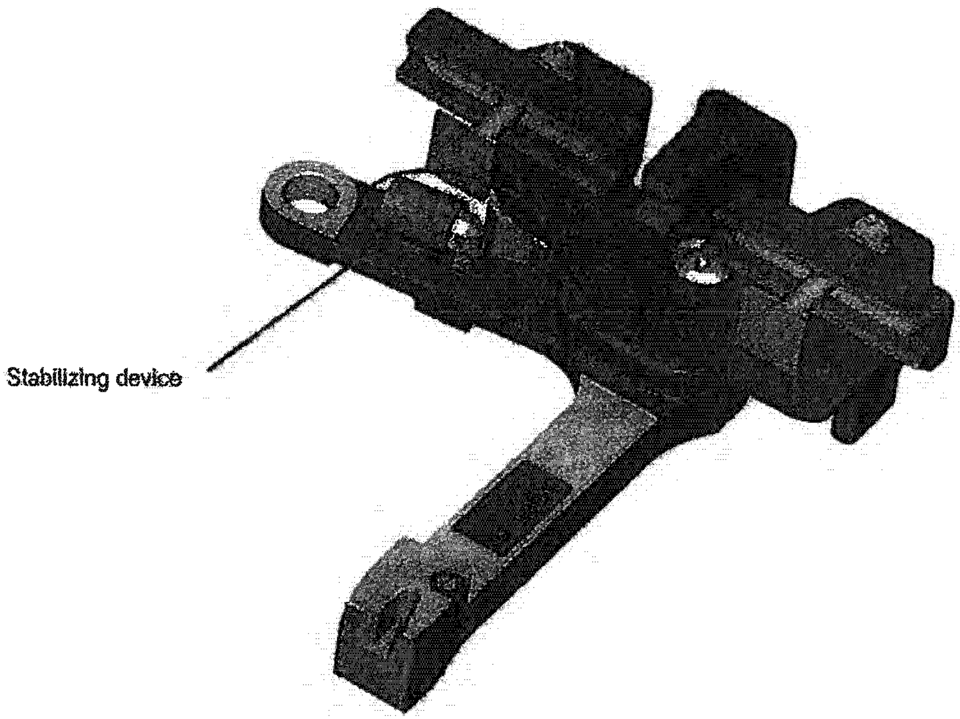
3- Stabilizing device

Both the wedged and the locked positions are held in place by the stabilizing device :



This device ensures that the C-arm will remain in its correct position even under heavy vibration.

3- OPERATION

The figure on following page shows a single turnout with VCC and its operation.

Case 1 : left blade closed and locked – right blade open and wedged

- The left C-head overlaps the locking piece, locking the left switch blade against the stock rail.
- The right C-head is engaged in the wedging chamber of the frame, wedging the right switch blade open.

Case 2 : un-locking of the left blade and un-wedging of the right blade

The movement of the VCC coupling rod makes both C rotate simultaneously, disengaging the left C-head from the locking piece and the right C-head from the wedging chamber.

Case 3 : transfer of the blades. The left blade is moved to "open" and the right blade is moved to "close"

The movement of the VCC coupling rod makes both blades transfer. Both C-heads slide into the corridors of the VCC frames.

Case 4 : locking of the right blade – wedging of the left blade

The movement of the VCC coupling rod makes both C rotate simultaneously :
- the left C-head engages in the wedging chamber, wedging the open left blade.
- the right C-head overlaps the locking piece, locking the right blade against the stock rail.

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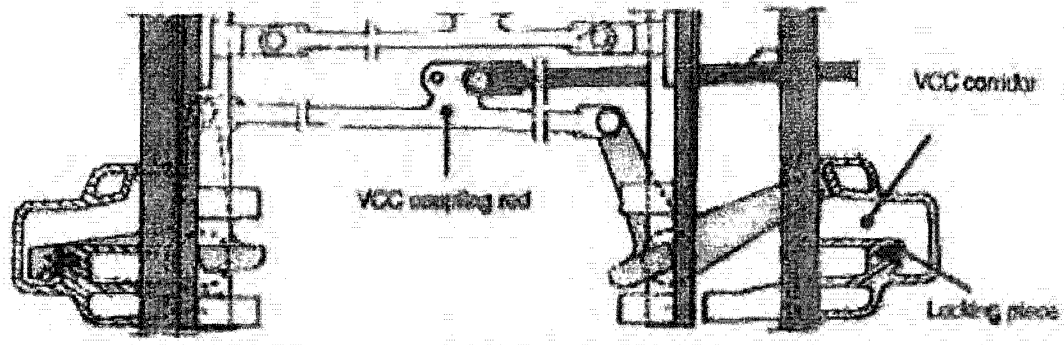
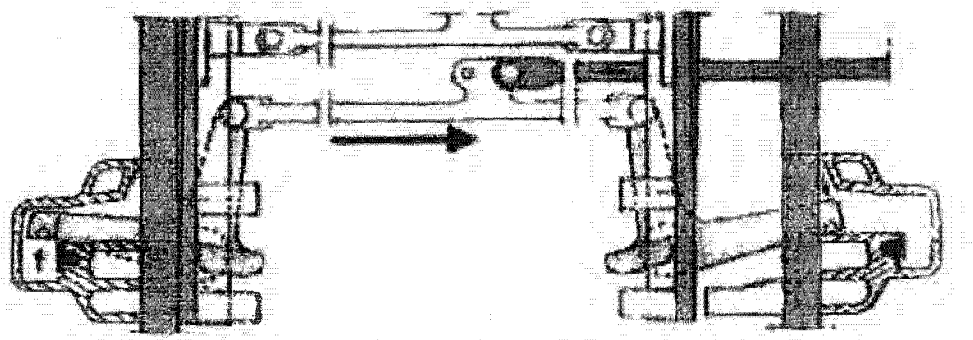
Top view :

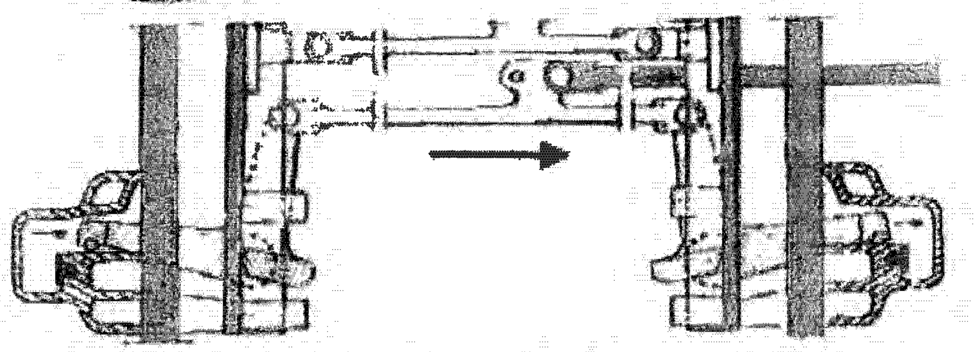
Case 1



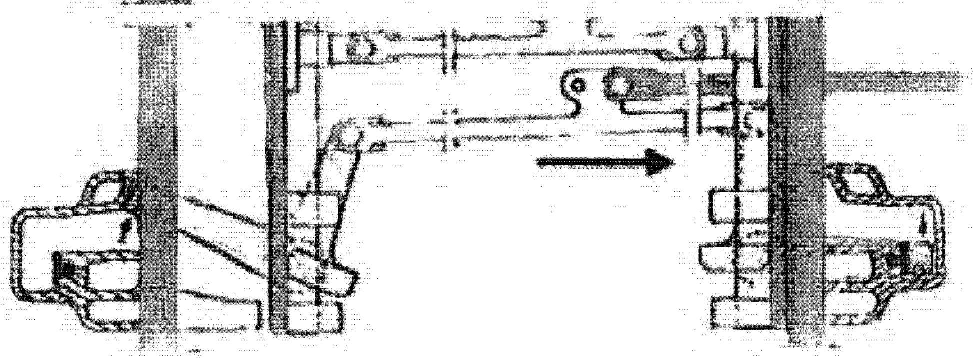
Case 2



Case 3



Case 4



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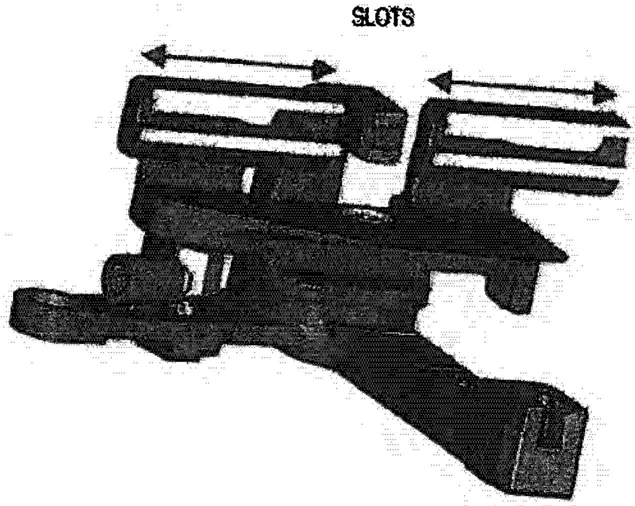
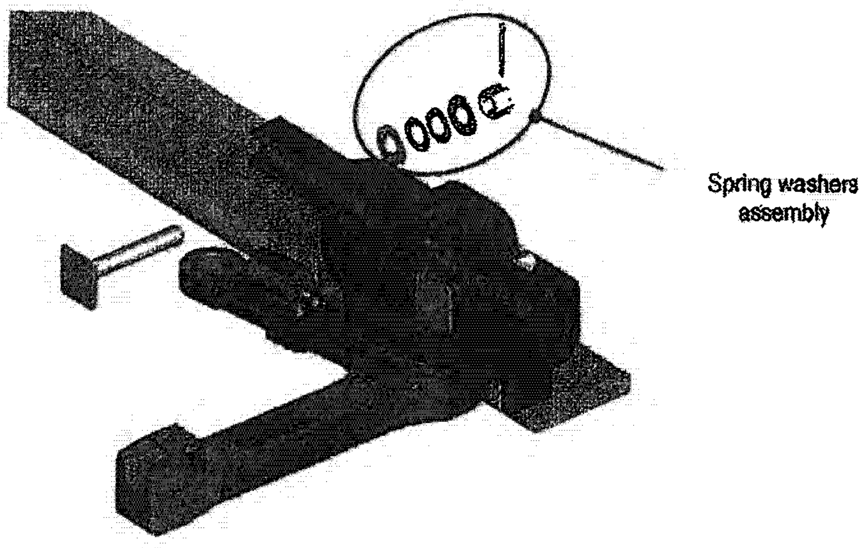
4.THERMAL EXPANSION

The C-arm has been designed to be able to operate even with a switch blade longitudinal thermal expansion of ± 55 mm. Indeed :

- the fixing bracket is slotted :



- the C-arm assembly, through the fixing bracket, is fastened onto the switch blade by two hammer head bolts and an assembly of spring washers :



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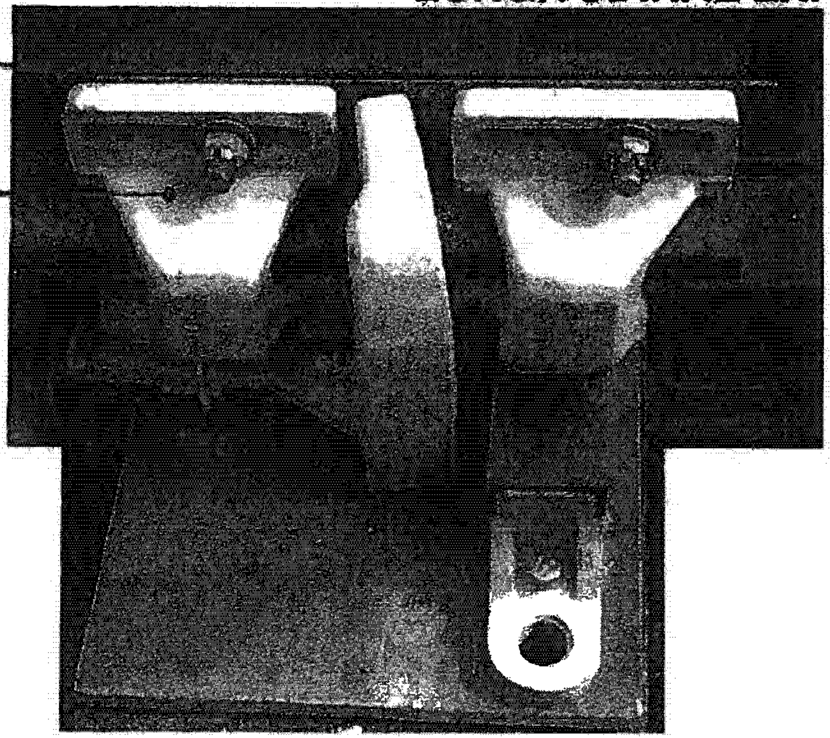
Consequently the switch blade can expand longitudinally along the fixing bracket :

LONGITUDINAL EXPANSION

Switch blade

Fixing bracket



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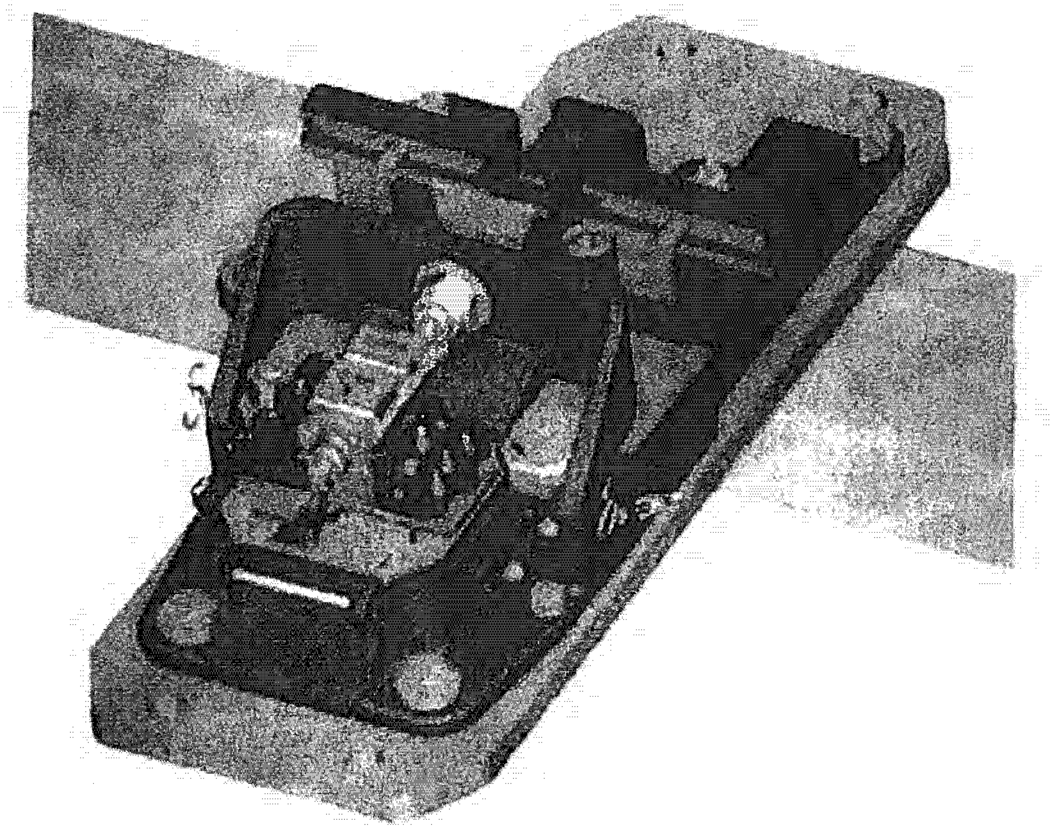
Switch Systems



TECHNICAL MANUAL

CLAMP LOCK DETECTOR

Document No. 1010-200-003 REV 0   Date 08/12/2006

This document is non contractual and may be modified without prior notice

CONTENTS

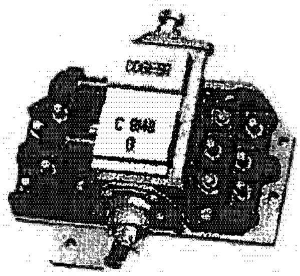
1. INTRODUCTION

The VCC detector has been designed to perform the following functions :

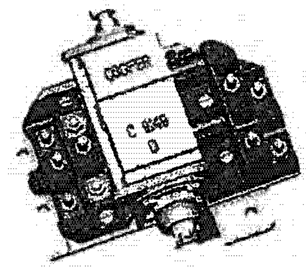
- detect the opening of the open switch blade
- detect the correct closing and locking of the closed switch blade.

Double-pole contacts are used on both these functions.

The VCC detectors are available in two symmetrical versions :
- a left-hand version, to match the left-hand VCC or movable point lock.
- a right-hand version, to match the right-hand VCC or movable point lock.

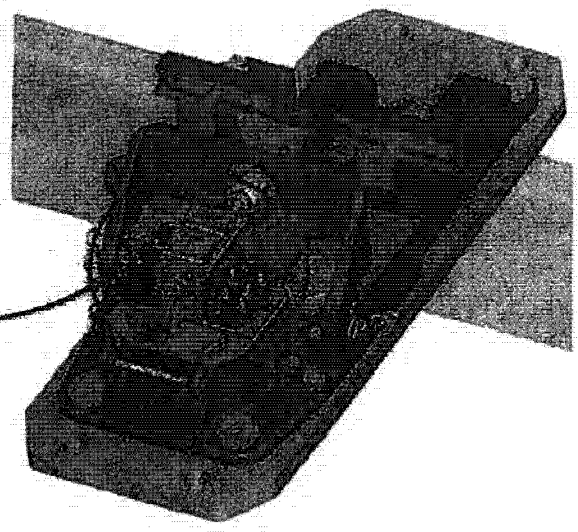


Left VCC detector



Right VCC detector

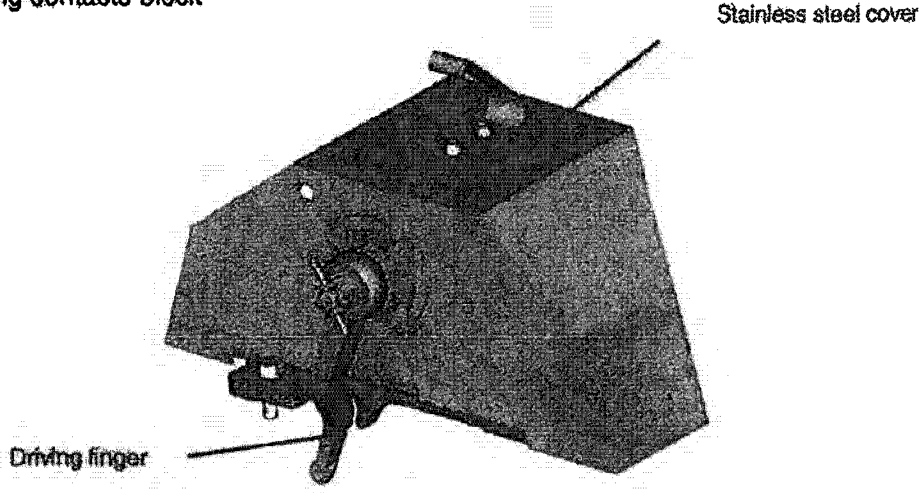
The Clamp lock detector is fixed on the frame of the VCC Clamp Lock :

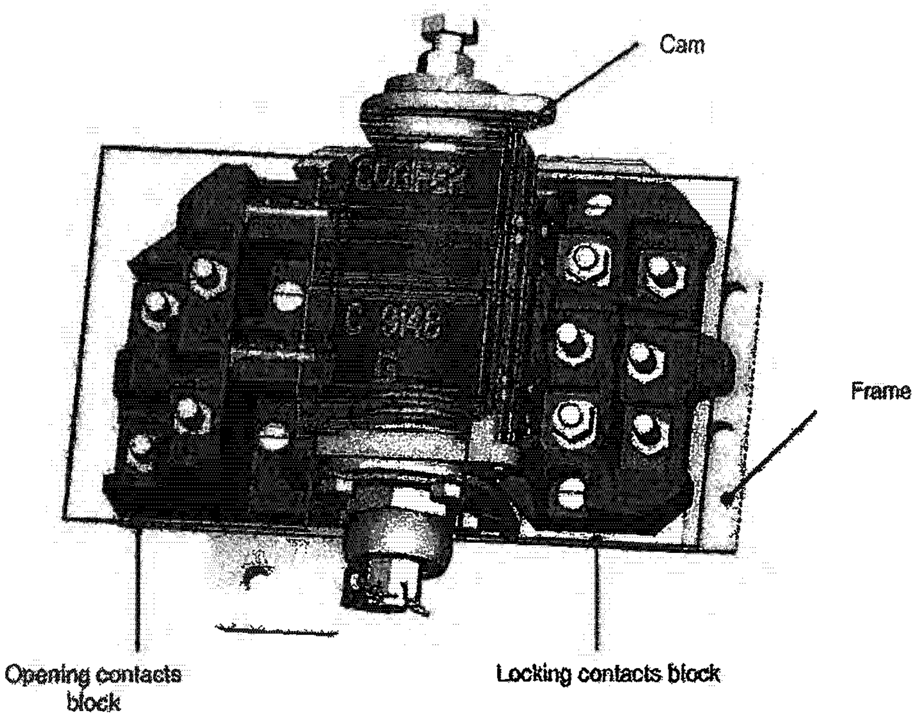


2. DESCRIPTION

A VCC detector consists of :

- a frame
- a stainless steel cover
- a rotation cam, integral with a driving finger
- a opening contacts block
- a locking contacts block





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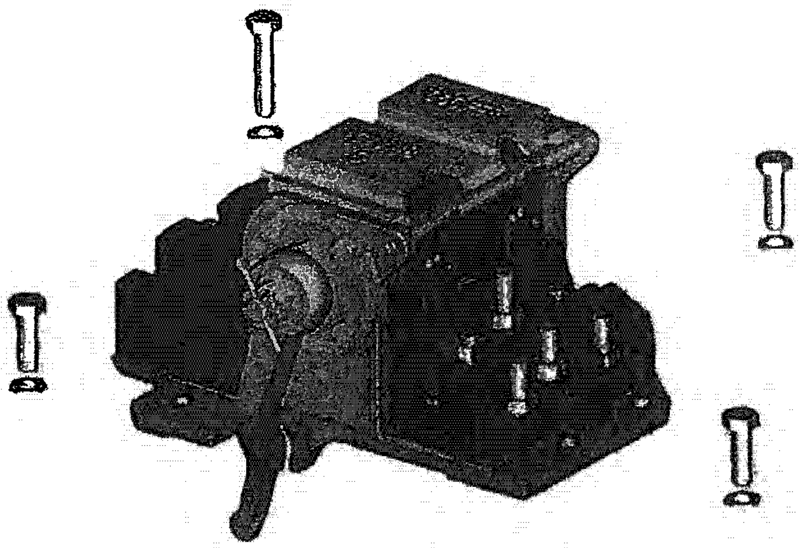
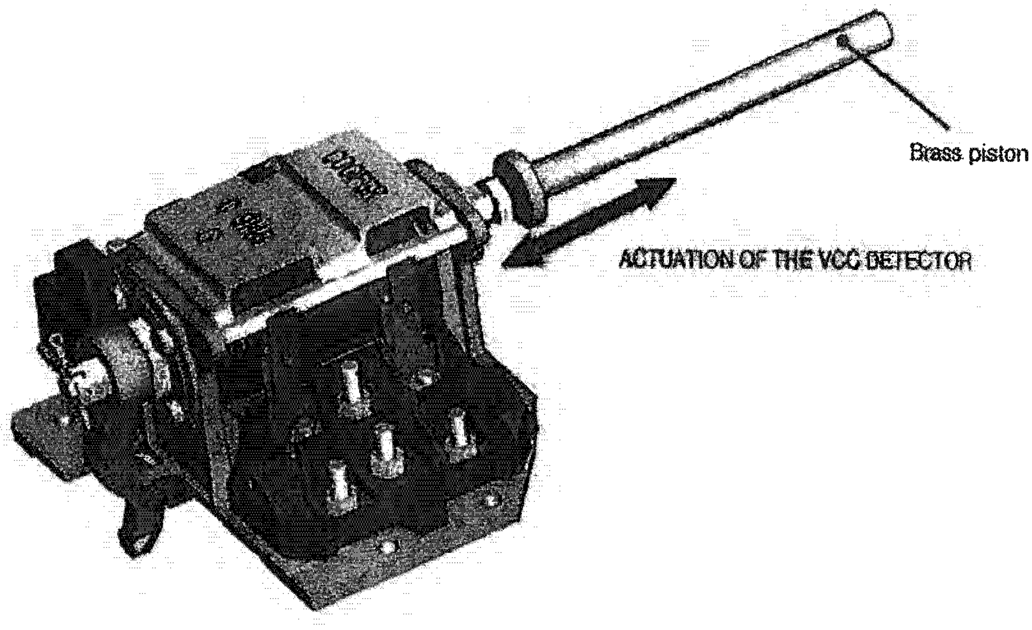
The frame is fastened onto the VCC frame with 4 screws :



Left VCC detector with its 4 fastening screws

The VCC detector is always supplied with a brass piston that is inserted in the hollow bolt of the VCC frame. This piston will actuate the VCC detector :



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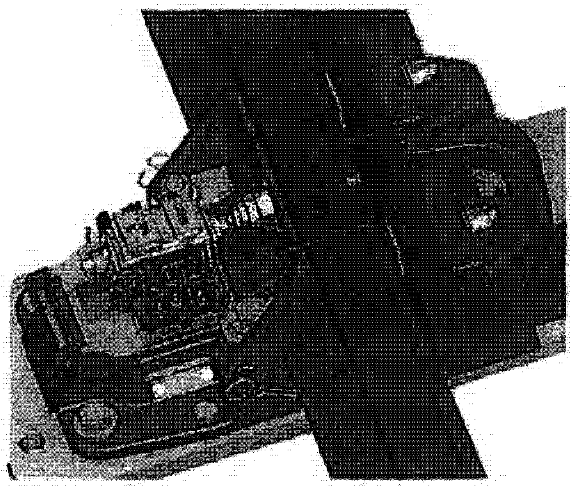
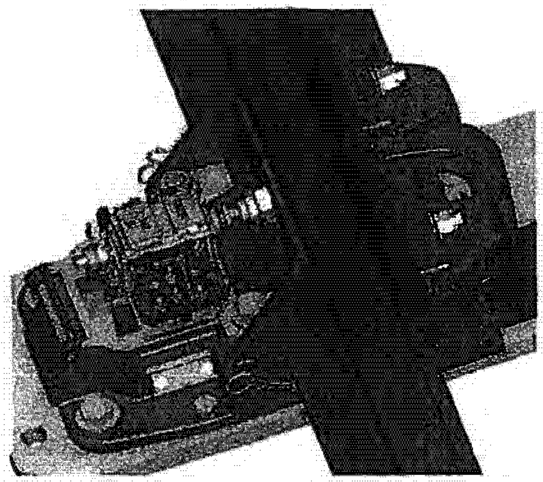
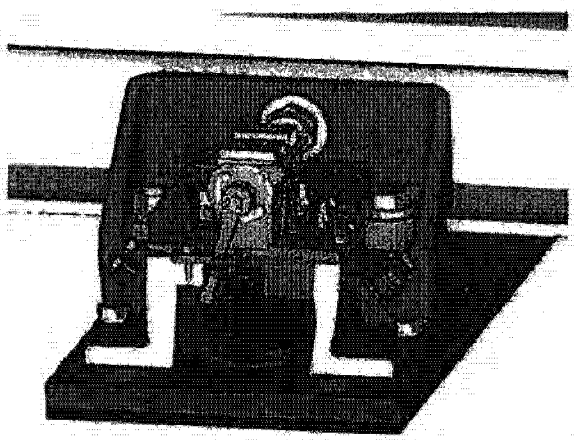
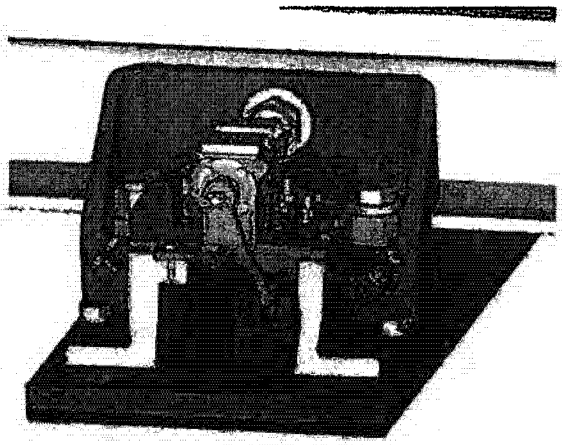
3. OPERATION

The VCC detector is actuated by :

- the brass piston, that is pushed by the switch blade :

- the C-head, that engages the driving finger and makes it rotate :

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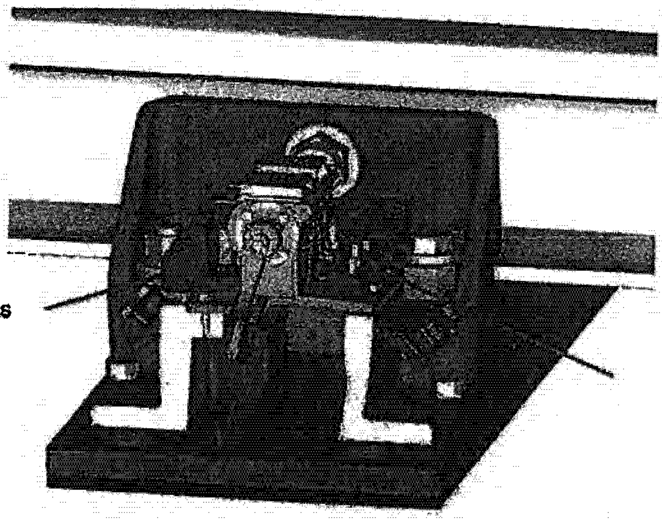
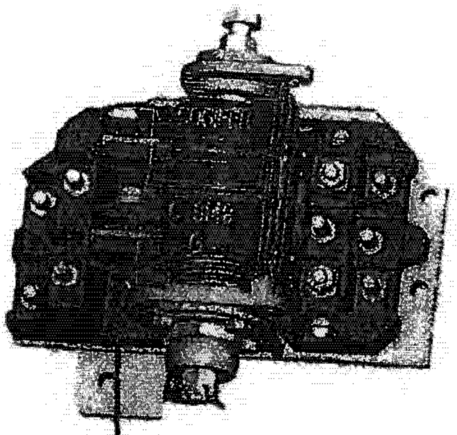
The operation of the VCC detector can be divided in 3 steps :

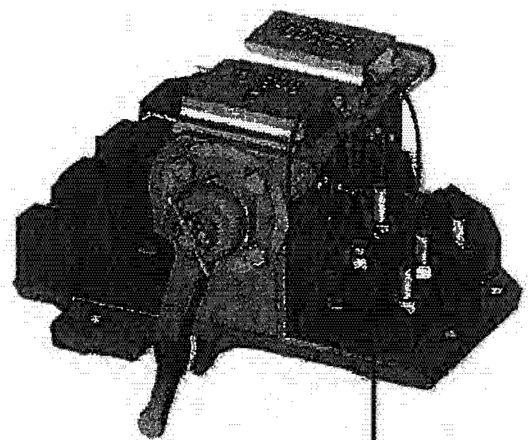
<u>Step 1 :</u> switch blade is closing

The C-head slides into the corridor of the VCC frame.
The state of the detector is :

- <u>Opening contacts :</u> closed
- <u>Locking contacts :</u> open





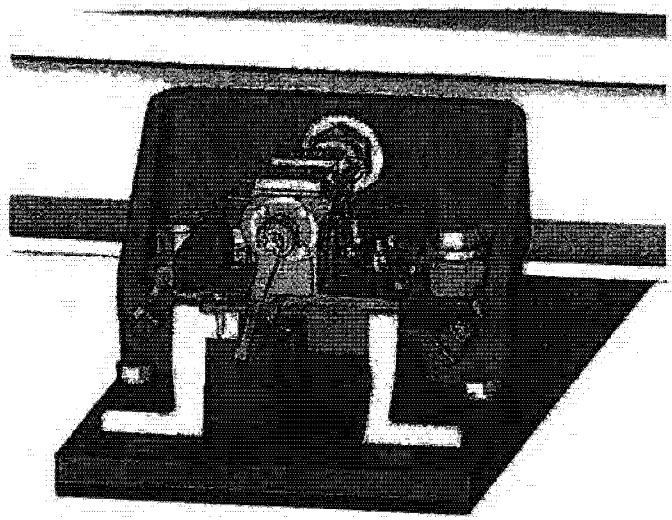


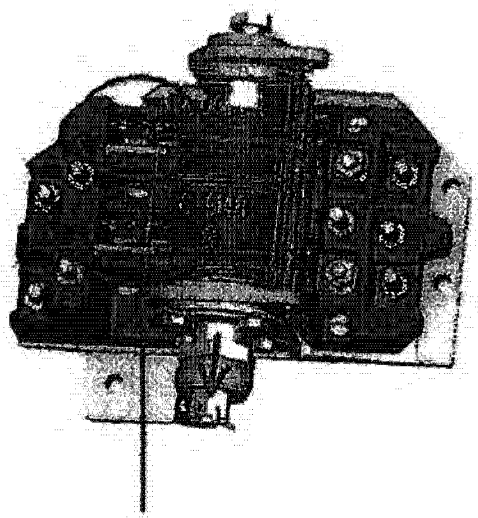
Step 2 : switch blade closed but not locked

The brass piston is pushed by the switch blade moving against the stock-rail : the piston pushes the cam, which opens the opening contacts.

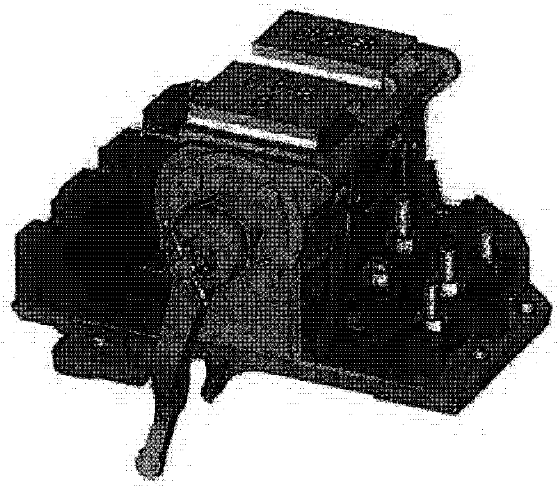
In the same time the C-head engages the driving finger.

The state of the detector is :
- Opening contacts : open
- Locking contacts : open





Opening contacts OPEN

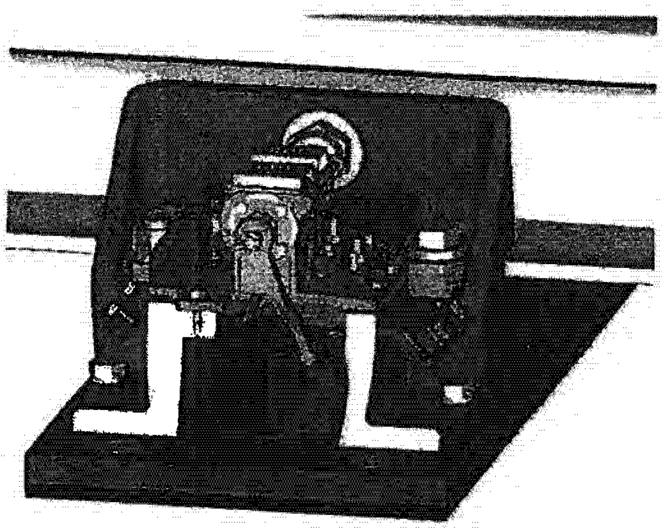


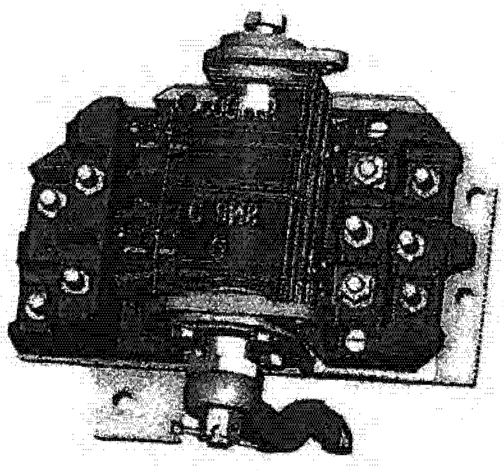
<u>Step 3 :</u> switch blade closed AND locked

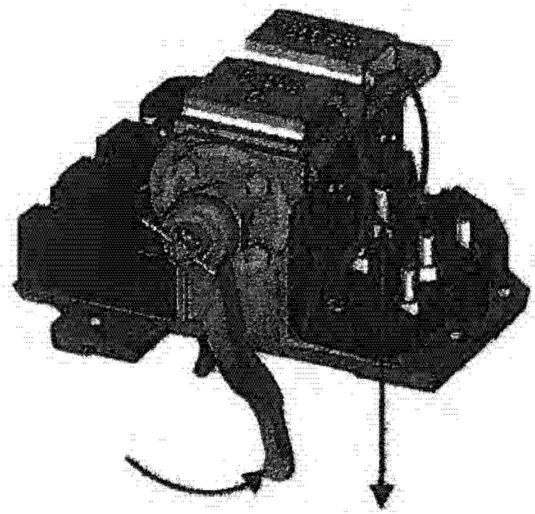
The C-arm rotates, making the C-head overlap the locking piece. This action makes the driving finger rotate along with the rotation cam, which in turn closes the locking contacts.

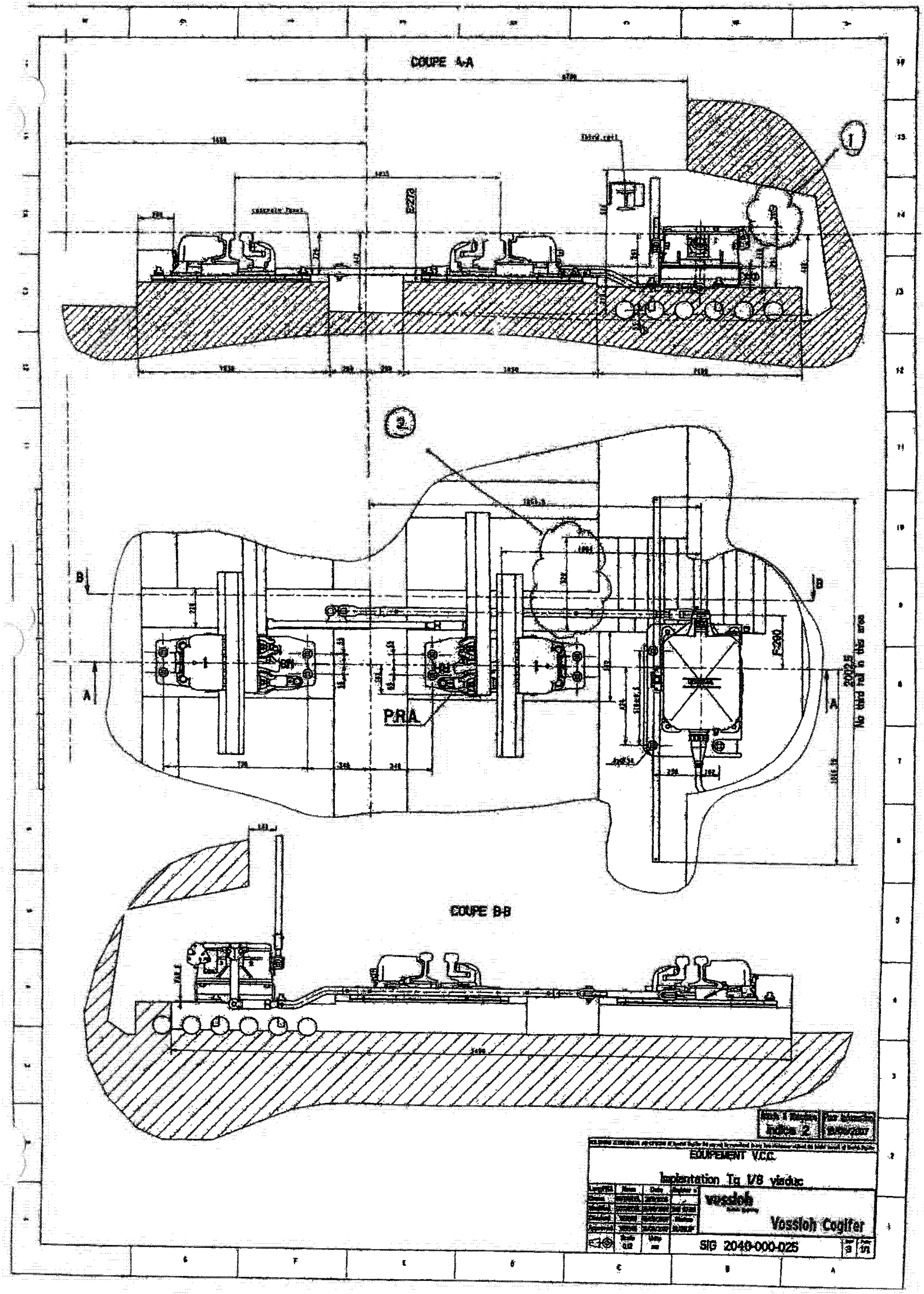
The state of the detector is :

- <u>Opening contacts :</u> open
- <u>Locking contacts :</u> closed









COUPE A-A
Third rail
E273
COUPE B-B
P.R.A
F200
2002,5
No third rail in this area
EQUIPEMENT V.C.C.
Implantation Tg 1/8 viaduc
vossloh
Vossloh Cogifer
SIG 2040-000-025
Indice 2

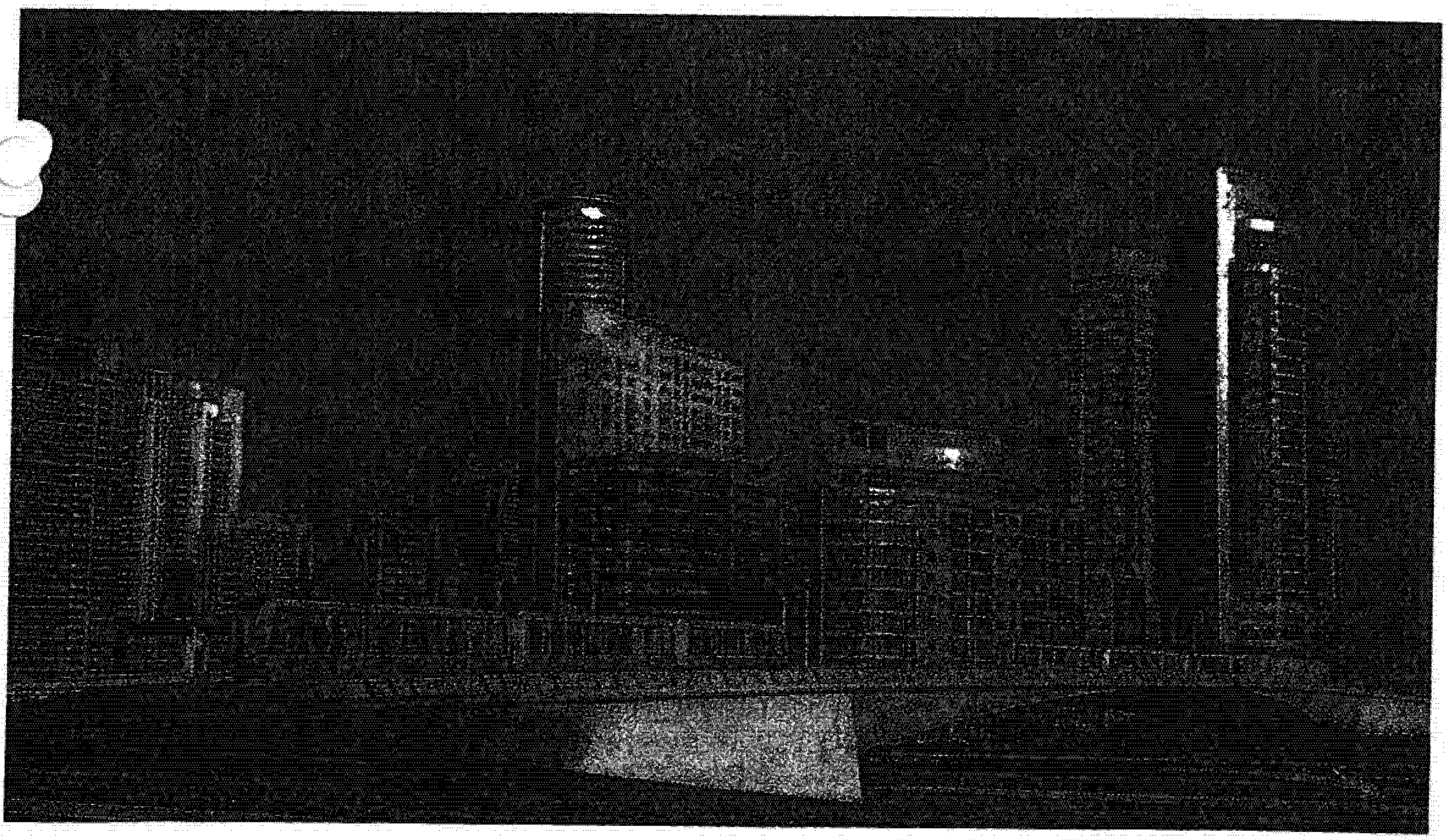
Siemens US

SIEMENS

Siemens Transportation Systems

Cityval®: New generation of Automatic Transportation System Honolulu Project

10 January 2008



REQUEST FOR INFORMATION 001

SUBMITTAL REQUIREMENTS

RESPONDENT CONTACT INFORMATION

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France -92323 Châtillon cedex

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Fax : +33 1.49.65.70.93

Submitting Siemens's Designated Representative : M. Ruediger Gritz

@mail : ruediger.gritz@siemens.com

CONTENT

- Submittal Requirements
- Introduction
- Cityval - New Generation of Automatic Transportation System 10 January 2008
- Request For Information Cityval Technology
- Val208 - System Preliminary Information - 9 January 2008
- Request For Information Val Technology

REQUEST FOR INFORMATION 001

INTRODUCTION

CITYVAL®: A PROVEN SYSTEM TECHNOLOGY

The Cityval® system is based on Siemens' thoroughly tested Val system, which has been in successful operation for over twenty five years. This section describes the operational history and the elements that make up the system.

Operational Experience

The Val system has been used for over twenty five years in various sites in both mass and airport transit applications. Val 206 was implemented from1983 to 1992. Val 256 was introduced in 1986, and Val 208 has been used since 1994. The updated version of the Val system is called Airval® for airport people movers (APM) and Cityval for mass transit implementations.

To date, the Val system has been implemented on 12 lines in 9 different sites, covering over 110 kilometers of dual track line. More than 600 cars have been delivered. Since 1983, over two billion people have been safely transported, without any system accidents.

Cityval Vehicle

The Cityval carbody is a new vehicle based on the proven principles and success of the Val system, which has been in service in a variety of locations and conditions for 25 years. The carbody, which was 2.08 meters wide with Val 208, has been widened to 2.8 meters or 2.65 meters to address the new capacity requirements of APMs, providing additional capacity and comfort.

The Cityval vehicle is today produced in Alsace (France) in a joint venture with Lohr Industrie, but vehicle design allows an easy localization in our industrial facility in Sacramento (CA). The Cityval vehicle benefits from the combined rich experience of Siemens and Lohr Industrie in traction and mechanical parts.

To ensure that the Cityval system meets expectations, it is validated prior to onsite installation during a thorough dynamic test phase that includes operating the vehicle, track, and automatic train control system in full automatic mode. This is done on a specific 600m long test track.

Driverless Train Control System

Cityval Driverless Operation is based on Siemens Trainguard MT CBTC System already proven.

Siemens successfully implemented the Maggaly driverless CBTC technology in France on Lyon Line D (a 13.5 kilometer subway system) in 1992, and the Meteor system on the high-capacity Paris Line 14 in 1998. In 1999, New York City Transit chose the Siemens solution, Trainguard MT CBTC®, for its Canarsie Line, which has been in successful operation since 2006.

Based on its previous success, the Trainguard MT CBTC is currently in production for Barcelona Lines 9 and 2; Budapest Lines 2 and 4; Paris Line 1; Algiers; Sao Paulo Line 4 and the Paris Ouragan project that covers lines 3, 5, 9, 10, and 12.

Siemens has played a leading role in CBTC technology, which has been implemented in a variety of heavily used, high-capacity systems, and continues to be. Siemens' extensive experience in this area ensures a reliable, long-term product life.

Guidance

The Cityval guiding system was developed by Lohr Industrie for its Translohr vehicle, which is a rubber tire tramway. The guiding system was first used in Clermont-Ferrand, France. Translohr is currently being implemented in Paris region in France, Shanghai in China, Venice and L'Aquila in Italy.

Translohr is already in passenger service since November 2006 in Clermont Ferrand (France), since February 2007 in Padova (Italy) and since June 2007 in TEDA (China) and has already traveled over the 1 million km trouble-free.

Power Distribution

Siemens has been designing, installing, and commissioning the power distribution system for all the Val turnkey projects since 1983.

Siemens keeps careful track of the maintenance activities of its turnkey projects, and uses the maintenance information to continually optimize the power distribution system. Siemens guarantees a high level of availability, which is especially important for systems that are in continuous use. The Cityval power distribution system incorporates the latest improvements and technology.

Station Equipment

Siemens has provided the passenger information systems (visual and audible announcement subsystems), CCTV system, emergency telephone system, station UPS equipment, and platform screen doors for its Val turnkey projects.

Siemens has 25 years experience in these areas, and its long cooperation with many different suppliers provides the Cityval system with the best available off-the-shelf solution.

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VAL208 SYSTEM PRELIMINARY INFORMATION

	Titre :	
Date : 19/01/07		Page : 1

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SUMMARY

1 PRELIMINARY SYSTEM DATA

1.1 Rolling Stock Basic performances.

Maximum service speed	80 km/hr
Starting acceleration at AW1 on flat track	1.3 m/s²
Constant acceleration	1.3 m/s² up to 26 km/hr
Deceleration nominal	Nominal: 1,3 m/s²
Deceleration Emergency (limited at 3m/s² according to ASCE regulation)	Minimum: 1,8 m/s² Nominal: 2,4 m/s² Maximum: 3 m/s²
Nominal service brake	1,3 m/s²
Minimum horizontal curve radius – main line for nominal performance.	150 m
Minimum horizontal curve radius – depot area	40 m
Minimum vertical curve radius – main line	1500 m
Maximum grade at AW1	7 % (up to 8% in special cases)
Maximum lateral acceleration in curves	1,3 m/s²

1.2 Summary on VAL 208 System

Basic Data	
Train Composition	2 cars 13 m long each. Total length of train: 26 m approx.
Range of ambient temperature for nominal performance	For external equipment: up to + 40°C For internal equipment: up to + 55°C
Maximum heavy rain fall	5 cm/hour with adequate operating procedures
Maximum wind speed	30 m/s for normal operating mode 35 m/s with adequate operating procedures
Inertia weight	4300 kg
Train running resistance	R=1400+0,1xM+75V+C(V+W)²+pMg M: weight; V: vehicle speed (m/s); W: wind speed (m/s); p: gradient; g= 9,81 m/s²; C=4
Maximum adhesive coefficient	0,85
Maximum jerk	0,65 m/s²

Maximum deceleration: Nominal braking mode Emergency braking mode	1,3 m/s² at AW2 no slope and no wind condition until full stop. Minimum: 1,8 m/s², nominal: 2,4 m/s², maximum: 3 m/s²
Maximum gradient for normal starting conditions	8% for normal starting conditions 3% for starting conditions with 50% of motors capacity
Interior noise levels, mode slow in opened area	Vehicle stationary, doors closed: 73 dBA Vehicle running at 16 km/hr: 75 dBA Vehicle moving at 60 km/hr: 76 dBA
Exterior noise levels in Leq 5 sec in opened area	Vehicle stationary, doors closed, at 5 meters: 70 dBA Vehicle running at 16 km/hr at 15 meters: 70 dBA Vehicle running at 60 km/hr at 15 meters: 75 dBA
Vibration	Compliant with ISO 2631 for 25 minutes exposure
EMI/EMC reduction measures	Compliant with EN 50121-3-2 standard
Suspension comfort	Satisfy ISO standard 2631-1 for 25 minutes exposure at boundary reduces comfort
Properties of interior materials	Fire resistant, low smoke emission as per NF F 16 101 standard
Vehicle body strength	Compression strength of car-body: 270 000 N at coupling at 2/3 of the yield limit. Relative speed of 2 married-pair without serious damages: 8 km/hour
Scheduled speed - maximum speed	60 km/hour - 80 km/hour
Recovery allowances	2 seconds on dwell times 3 seconds maximum on line between stations according to track layout.
Power regeneration rate	Fm / (Fm + Fe) <= 10% Fm: mechanical brake effort Fe: electrical brake effort
Traction force (for a vehicle)	F=8xCx4,89x0,95x1/0,484 C: torque for 1 motor
Regenerative braking force (for a vehicle)	F=8xCx4,89x1/0,95x1/0,484 C: torque for 1 motor

Length of vehicle	26140 mm
Width at door threshold	2074 mm
Maximum height from top of track (over HVAC)	3675 mm
Vehicle Floor Height above top of track	950 mm

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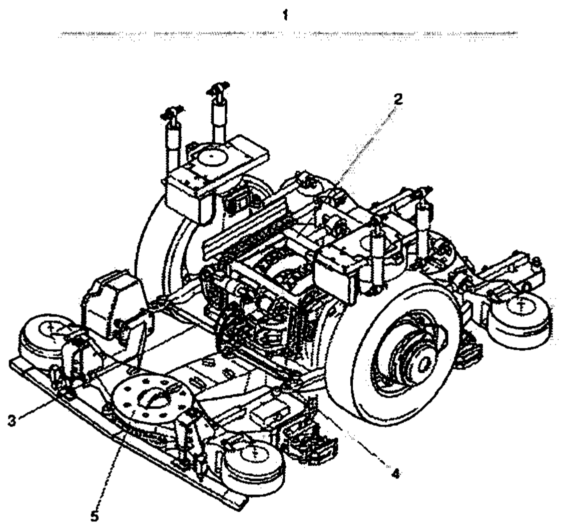
Vehicle Ceiling Height above relative to the floor	2050 mm
Platform levelling tolerance	+ 9 mm, - 35 mm
Door width –12 per married-pair	1300 mm
Door height	1945 mm
Door opening per side per married pair	6
Track Gauge – Distance between guidance rails	2130 mm
Bogie Wheel base	1620 mm

Coupler	Automatic coupler at each end of vehicle
Car body	Painted aluminium insulated sandwich panels, curved sides
Crashworthiness	Crashworthiness capability up to 8 km/hr with no permanent structural deformation
Passengers windows	Large windows fitted with laminated high impact safety glass compliant with the French related standards.
Windshield	Laminated type compliant with the French laminated glass standard.
Seats	18 seats per car –
Floor	Welded extruded aluminium plates.
Bogie	4 rubber tires bogies per vehicle, with orientating running wheels.
Communication	One complete communication system per vehicle
Information Sign System	Pictograms and stickers provided. Dot Matrix Display
On-board video - optional	2 cameras per car. One on-board recorder per married-pair.
Monitoring	One On Board Control Unit – OBCU – per vehicle Data / function link with the OCC
EMI	Rolling stack compliant with NF EN 50 121-3-2 (European standard)
Wiring	In accordance with the standard NFF 16 102 July 89 or NF F 63 295

1.3 VAL 208 main features.

1.3.1 Bogies.



1 VAL 208 bogie with suspension system.
2 Inner beam.
3 and 4 Direction rods.
5 Switching roller.

The bogies are rubber tires bogie types with orientating running wheels.

Each vehicle is fitted with 4 of them.

Two original and unique design options have lead in the design of the VAL 208 bogie:

- ✓ Two hub-wheel types motor per bogie.
- ✓ Orientating running wheels.

1.3.2 Traction motors.

Each vehicle is fitted with 8 three-phase AC synchronous traction motors, hub-wheel type. Provided with the control system, power supply energy recovery – so called ED braking – is also possible.

Per car, 2 traction inverters based on IGBT power transistors are installed under the car-body.

The traction system can monitor either 4 axles (100 % motorization), or 3 axles (3/4 motorization) or 2 axles (1/2 motorization).

1.3.3 Service braking system.

The braking system is designed with the fail safe principle meaning that the indirect spring brake is released in case of pressure failure in the braking hydraulic-system.

The braking system is mainly composed of:

- The brake discs and braking groups (callipers and pads) : 8 discs per married pair, 1 calliper per disc
- Two hydraulic units per vehicle.
- One twin-rack electronic control unit per vehicle.
- Sensors for the brake discs temperature monitoring in order to avoid of permanent braking situations.

1.3.4 Emergency braking system.

The emergency brake is provided by the friction brake only. The emergency braking instruction is directly transmitted to the friction brake by the Automatic Train Control – ATC.

The braking force is applied by a mechanical spring without fluid transmission, in order to provide the required safety level.

The emergency brake effort guarantees a 1.8 m/s² minimum deceleration to the vehicle in for any load case, under no slope and no wind conditions up to the full stop of the train.

1.3.5 Train control and monitoring.

1.3.5.1 Automatic Train Control.

The train control and monitoring is fully automatic – driverless and no attendant on board - through Wayside Control Units – WCU – and On Board Control Units – OBCU - based on the principles of intrinsic safety.

Passengers' safety has constantly lead in the design of the system.

1.3.5.2 Manual Train Control.

In the depot area, mainly to enter or exit the maintenance hall, or in case of emergency on line, when other recovery procedures have failed, manual driving of vehicle is possible using manual driving panels placed at each end of the married pair.

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2 TRAIN CONFIGURATION AND PRELIMINARY FLEET SIZE.

2.1 Track alignment data summary.

	Alignment
Number of passengers stations:	XX stations.
Main Line Elevated Dual Guide-way Length	XX km approx.
Main Line At-Grade Dual Guide-way Length	XX km approx.
Main Line Underground Dual Guide-way Length	0 km
Line in Maintenance & Storage Facilities Area	XX km approx.
Total Length of Single-lane Guide-way	XX m approx.
Maximum Grade requirements main line	7%, up to 8 %in special cases
Minimum Radius of Vertical Curve requirements ✓ Main Line ✓ Maintenance & Storage Facilities	 1500 m 1050 m
Minimum Radius of Horizontal Curve requirements for nominal performance. ✓ Main Line ✓ Depot	 150 m 40 m

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XXX Transit Link
Line diagram

	Titre :	
Date 11/01/08		Page : 9

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2.2 Train configuration

Train Composition	2 cars 13 m long each. Total length of train: 26 m
Passenger Capacity per vehicle AW1 (AW1: design capacity)	220 passengers per vehicle, 60 kg/passenger, 36 seated, 184 standees. Area per seated passenger: 0,4 m² Area per standing passenger: 0,17 m² approx.
Passenger Capacity per vehicle AW2 (AW2: crush load capacity)	236 passengers per vehicle, 60 kg/passenger, 36 seated, 200 standees. Area per seated passenger: 0,4 m² Area per standing passenger: 0,16 m² approx.
Maximum static loads	AW0: 31100 kg – empty vehicle. AW1: 45400 kg AW2: 46480 kg

2.3 Estimated fleet size

As the track alignment is not defined in details, the commercial speed cannot be accurately calculated and is expected to be XX km/h including a dwell time at stations XX seconds. The resulting fleet size is then as following

Commercial Speeds	**30 km / hr to 34 km / hr**
Traffic demand - pphpd	XX
Passengers per vehicle (typical arrangement): 36 seated, 184 standees	220
Estimated minimum headway - seconds	XX
Operating fleet at peak period	XX
Spare vehicles for maintenance – 10 % approx.	XX
Total fleet – Married pairs	**XX**

2.4 Operating modes.

2.4.1 Normal operating mode.

Pinched loop operation

2.4.2 Failure operating mode.

Automatic push recovery of stalled train.....

3 TRACKWAY AND PRELIMINARY LOADING INFORMATION FOR STRUCTURAL DESIGN.

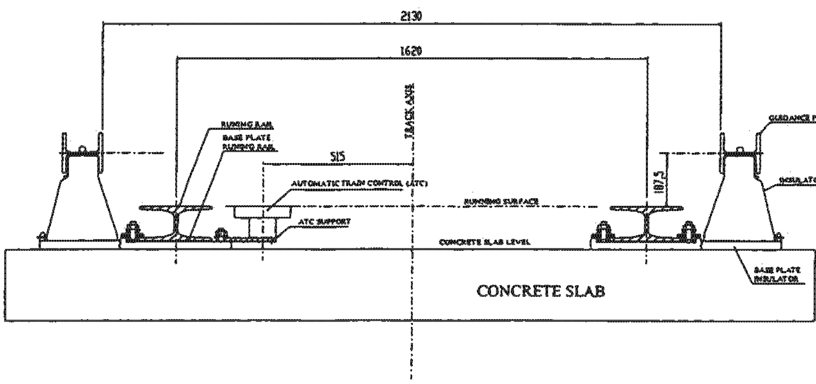
3.1 Typical trackway structure

The trackway of the VAL system consists in:

- Two steel running surfaces.
- Two lateral guidance rails that also supply the traction power to the vehicles fitted onto insulators.
- Trackway switches.
- Emergency walkways as required by the local regulations.
- Cabletrays.
- End of track buffers.

The design of the track allows important super-elevations and longitudinal slopes, but also short curve radius.

- Maximum super-elevation: 12 %.
- Longitudinal slopes: 7 % (up to 8% in special cases)
- Minimum curve radius: 40 meters mainly adapted for the depot area.

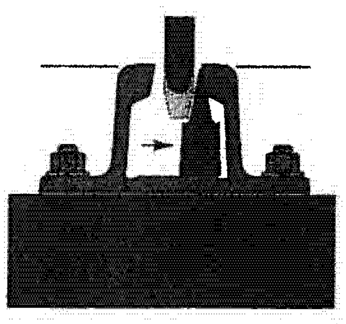


TRANSVERSAL SECTION ANCHORED TRACK
METALIC RUNING RAIL

3.2 Switches

The VAL System switches are central guidance type switches.

Since guidance-and-power rails are discontinuous in switch area, vertical steel discs mounted onto the bogie/truck guide the vehicles.



The discs are guided by a groove at the centerline of the track.

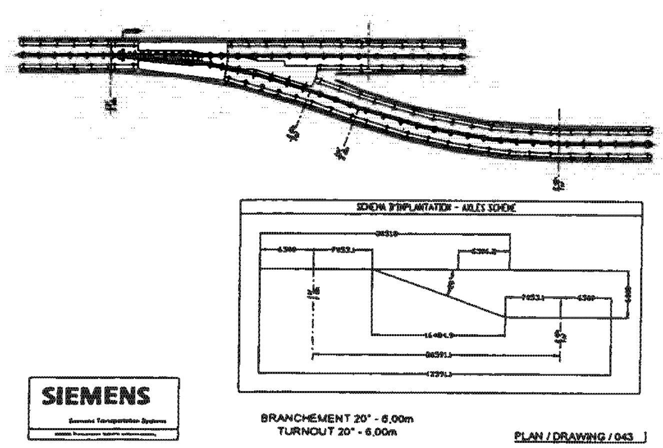
<u>Central Guidance Principle</u>

Switches are operated automatically in normal mode by a remote control command from the Wayside Control Unit (WCU), except in the depot area where switches are operated from a local control panel.

They can also be set "manually" from the local control panels located along the guide-way or by mechanical levers.

Each switch includes one or several local control panels, and one or several command cabinets implemented in a technical room nearby the switch.

For an optimum design, different types of switches are used - Turnouts, Single Crossovers, Scissors – according to the project requirements.



3.3 Loading information for structural design.

3.3.1 Geometrical criteria

3.3.1.1 Tangent sections

Minimum length of tangent between curved sections of mainline including reverse curves: 10 meters straight alignment.

3.3.1.2 Curved sections

Minimum length of tangent between compound curves and reverse curves: 10 meters of straight alignment.

3.3.1.3 Spiral curve

Clothoïds (spirals) are used to connect straight alignments and curves on the line and on the test track, but not on tracks in the depot.

Design formulation for spiral curves is: A=RxL = constant where R represents variable radius at different length L

Maximal clothoïd length depends on radius of the curve, bank and running speed. The exact value of clothoïd length is calculated for each curve.

3.3.1.4 Minimum Plan Radius

In the depot area, minimum radius is 40 meters.

On the main line, minimum radius is 150 meters.

However, the speed of the vehicle can be reduced for smaller radius to taking into consideration the transverse acceleration not compensated by track super-elevation.

The distance between track centrelines must take into account horn effect and middle effect of trains on adjacent tracks. Therefore, a curve with a radius shorter than 150 m should be exceptional.

Changes in alignment requirements must be checked and approved by STS.

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3.3.1.5 Horn effect and middle effect.

The vehicle clearance envelopee must be adjusted to account for the effect of overhang, throw-over.

Radius m	Horn effect mm	Middle effect mm
40	**134**	**330**
60	**92**	**220**
100	**56**	**132**
150	**38**	**88**
200	**29**	**66**
250	**23**	**53**
500	**12**	**26**
1000	**5**	**13**

3.3.1.6 Super-elevation

Super-elevation is calculated according to the speed and the radius of curved and spiral sections in order to satisfy riding comfort.

The lateral non-balanced acceleration by super-elevation, limited to a maximum value of 1.05m/s², is verified using the formula: $\gamma = V^2/R - d \times g < \gamma$ max,

where V= speed limit - 22.22m/s; R= curve radius; d= super-elevation and g = 9.81m/s².

The maximum super-elevation is set at 12 percent.

The maximum super-elevation variation is:

6 mm/m for radius with a profile radius greater than 1500 m,

3 mm/m for radius with a profile radius between 1050 and 1500 m.

The variation of γ during the time duration needed to cover the spiral, limited to 0.59m/s^{3,} is verified using the literal formulation: $\Delta\gamma / \Delta t < 0.59\text{m/s}^3$.

The variation of super-elevation with the time duration, or distortion, is limited to 4%/sec.

These formulas are used as first approximation with a constant speed.

3.3.1.7 Track vertical profile

In the depot area the minimum radius for vertical curve is R = 1050 m,

On the line, the minimum radius for vertical curve is R = 1500 m.

3.3.1.8 Track alignment in stations

For one married-pair, the following alignments are required at each station location:

- Plan layout : 46 m in a straight alignment (length of a station + 20 m),
- Vertical profile: 26 m on a 0% constant slope (length of a station).

3.3.1.9 Track switches

The track switches are located in straight alignment areas, with **maximum 4% constant slopes.**

In addition, beyond the 40 m radius of the switches, the following straight alignment and constant slope must be provided:

- Plan layout: 16,50 m straight alignment,
- Vertical profile: 13,00 m constant slope.

If necessary, the straight alignments in plan layout can be reduced for track switches in the depot area.

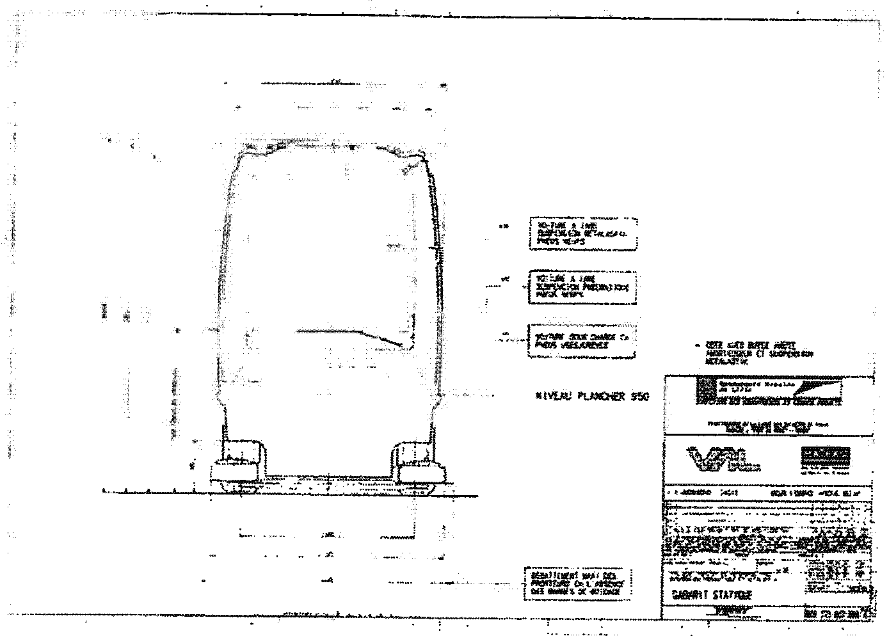
3.3.1.10 Expansion joints

The optimum average spacing between two consecutive expansion joints of the supporting structure is around 108 m in typical section.

Expansion joint are not allowed:

- within the 2 extremities of a switch (from one central groove end to the other),
- within a 20 meter long area, on both side of a station centreline,
- between two contiguous switches.

3.3.1.11 VAL 208 static envelope



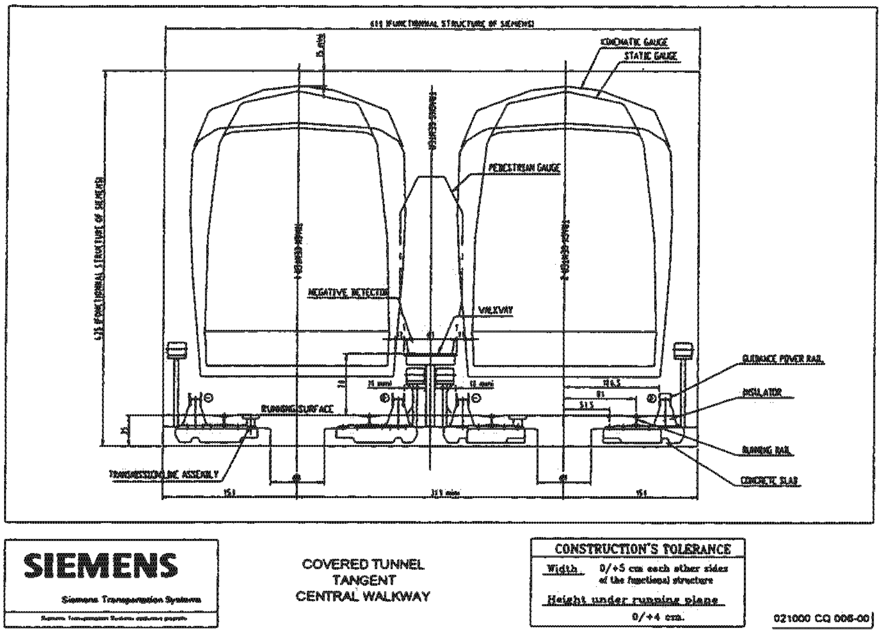
The following static dimensional characteristics of a 26 meter long married-pair VAL 208 train:

- Lateral area of a vehicle: 93.2 m²,
- Lateral guidance wheels base: 2280 mm,
- Pre-stressed guidance gauge: 2130 mm,
- Running wheel gauge: 1620 mm,
- External width of body: 2080 mm,
- Overall height with respect to the rail (new tires, no load): 3675 mm,
- Floor height above running surface (no load): 950 mm,
- Length of a married-pair (between couplers): 26140 mm,
- Position of the centre of gravity with respect to the running surface (empty vehicle, estimated value): 1650 mm,
- Position of the point of application of the wind with respect to the running surface(no lateral screen, pessimistic forecast value): 2120 mm

3.3.1.12 VAL 208 dynamic envelope.

The following figure shows a typical VAL 208 dynamic envelopee in straight alignment.

The location and size of the emergency walkway are subject to modifications according to the prevailing regulations.



3.3.2 Loads schedule

3.3.2.1 Acceleration and deceleration constraints at 0 % slope (for Civil Works design only)

Maximum program speed:	**80 km/hr (+ 10 % overspeed).**
Transverse accelerations:	**Nominal, not compensated by super-elevation: 1.05 m/s², Maximum variation: 0.65 m/s³.**
Longitudinal accelerations:	**Nominal service acceleration: 1.30 m/s², (γL)** **Nominal service deceleration: 1.30 m/s², emergency deceleration: 1.8 m/s² to 3.00 m/s². (γEB)**
Wind speed:	**Nominal operating limit: 110 km/hr,** **Operating limit with onboard operator: 130 km/hr,** **System survival limit: 180 km/hr.**

3.3.2.2 Loads taken into account for elevated guide-way structural design

The elevated guide-way is designed to sustain any load due to the fixed equipment (track equipment and others) and the vehicles including, when applicable, sound barriers, aesthetic barriers, emergency walkways whether in single track or dual tracks.

Loads such as wind, temperature, earthquake and weights of Non System Equipment must be added in the load combinations according to prevailing codes.

The Civil Work is designed to accommodate the vehicles loaded at maximum capacity i.e. AW2.

Due to push recovery capability of the VAL system, 2 Married pairs loaded at AW2 can be operated together on the same track.

3.3.2.3 Static loads of track equipment

The static loads to be taken into account for one track are:

- Steel running rails and fittings: 215 kg/m,
- Guidance rail, insulators and attachments: 95 kg/m,
- Transmission line assembly and supports: 25 kg/m,
- Emergency walkways and cable: 150 kg/m.

Structural concrete works to be added:

- Concrete slab supporting the track ,
- Edging strips and guard rails (if any),
- Provision for additional equipment (depending on local regulations),
- Any guide-way equipment such as sound-barrier panels, parapets, refuges, planters, station loads if any, etc.,
- In switch areas, additional static loads must be added (to be provided at contract award, as these values depend on the type of structure and on local regulations).

3.3.2.4 Static loads of a VAL 208 train

Notice: The following figures relate to the maximum weight to be taken into account as an hypothesis by the civil work basic design for a 26 meter long married-pair VAL 208 train.

Number of passengers per married-pair (18 seated)	STS reference with 65 kg passengers	Number of standees per m²	**Typical maximum weight for a married-pair**
0	AW0	0	**31 100 Kg**
220	AW1	6	**45 400 Kg**
236	AW2	6,4	**46 480 Kg**

3.3.2.5 Dynamic loads of a VAL 208 train

The dynamic loads depend to a large extent on prevailing regulations.

Therefore, only the elementary loads generated by the vehicle on the trackway are indicated. The combinations of these loads must be established according to the regulations. These loads, without safety factors or increase, are detailed hereafter.

For longitudinal efforts (acceleration and deceleration), the equivalent mass due to rotating inertia (MRI) is equal to a mass of 4300 kg per married-pair.

These global loads must to be taken into account for the structural design calculation.

Notice: ISO units, kg, N, m, m/s, m/s², etc, are used hereafter.

3.3.2.6 Definition of elementary dynamic loads

FV = vertical load positive downward applied at gravity center

FL = longitudinal load positive if acceleration

FT = horizontal load transverse positive if centrifugal force

3.3.2.7 Case 1 (AW0):

Vehicle stopped, no passenger on board, **for one car**.

FV = 153 KN   FL = 0 KN   FT = 0 KN

The effort resulting from case 1 is called **Qv.**

3.3.2.8 Cases 2 and 2'

3.3.2.8.1 Case 2 (AW1):

Vehicle loaded at AW1 running at the programmed speed, braking or accelerating normally, **for one car:**

FV = 223 KN   FL = ± 33 KN   FT = M γ tl

γ tl =± 0.5 ms^{-2} in straight line

or γt1 = min (γ to + 0.5 + 9.8 d ;(490/R) + 0.5) ms^{-2}

With Υ to = maximal non-counterbalanced transverse acceleration allowed. Υ to = 1.05 ms^{-2} to or 1.30 ms^{-2}

d = running surface super-elevation

R = horizontal track curvature radius

The load resulting from this type of train element will be called **Qn**

3.3.2.8.2 Case 2' (AW1):

Vehicle loaded at AW1 running at nominal speed, **for one car:**

FV = 223 KN   FL = ± 33 KN   FY = M γt1

The load resulting from this type of train element will be called **Q'n**

3.3.2.9 Case 3 (AW2):

Vehicle loaded at AW2, worst case, **for one car:**

FV = 228 KN   FL = 114 KN   FT = M γ t2

γt2 = ± 1.0 ms^{-2} in straight alignment.

γt2 = - 1.0 ms^{-2} in curved section

= + ƒ®   in curved

Considering R = radius of the curve

If ϒ to = 1.05 ms^{-2}

ƒ® = 3050/ (R+650)   if R ≤ 220m

ƒ® =(540/R) + 1   if R ≥ 220m

If ϒ to = 1.30 ms^{-2}

ƒ® = 3250/ (R+650) if R ≤ 200m

ƒ® =(550/R) + 1   if R > 200m

The load resulting from this type of train element is named **Qes**

3.3.2.10 Notice :

The table hereafter is only applicable to a 26 meters long married-pair VAL 208 vehicle, with 18 seats per car and air-conditioning.

Values are given without surcharges or combination factors.

Dynamic factors must be applied according to the prevailing regulations.

F_V, F_T, F_L loads are given at center of gravity level. If necessary (e.g. for deck or pier transverse design), these loads may have to be applied at wheels, which can be done using the geometric characteristics.

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Vehicle configuration = 26 m married-pair.	Mass M	F_V	F_T	F_L	Occurrence level
1. Stopped	(℔)	Mg	0	0	Nominal
2. Program speed, nominal acceleration or deceleration	(℔)	Mg	$M\gamma_{t1}$	+/- $(M+MRI)\,\gamma_L$	Nominal
3. Program speed, emergency braking	(℔)	Mg	$M\gamma_{t1}$	- $(M+MRI)\,\gamma_{EB}$	Nominal
4. Overspeed	(℔)	Mg	$M\gamma_{t2}$	+ 100 KN	Failure
5. Overspeed emergency braking	(℔)	Mg	$M\gamma_{t2}$	- $(M+MRI)\,\gamma_{EB}$	Failure
6. Braking regulation default	(℔)	Mg	$M\gamma_{t1}$	+/- 240 KN	Failure
7. Jamming of live axle for 1 car: • jammed axle	(℔)	Mg	$M\gamma_{t1}$	- 0.425 Mg	Failure
8. Vehicle/vehicle collisions	AW0	Mg	$M\gamma_{t1}$	- 240 KN	Accident
9. Vehicle/buffer collisions	2 AW2	Mg	$M\gamma_{t1}$	400 KN for buffer design	Accident

(℔) The mass M has to be chosen according to regulations, and studied combinations.

3.3.2.11 <u>Load combinations</u>

The combinations of the above configurations must be established according to applicable regulations.

Each trackway may be used in either direction (manual driving), but for a dual-track guide-way, the two tracks may not be used at the same time in the same direction.

3.3.2.12 <u>Structural deflection</u>

The structural deflection under dynamic and/or static loads is limited according to prevailing codes.

For an elevated guide-way, the following rules apply, including shrinkage, creep, temperature effects and load.

- Bending deflection of the deck :

Deflection of each span is limited to 1/800 of the span length under the running loads of usual combinations (at least 2 married-pairs in load-case with an AW2 load in each direction) and delayed deflection, at any time.

The spans located in a concave profile radius less than 1 500 m (when loaded) must be specifically studied and checked by STS.

The structural design must take into account a counter camber so that the deflection under permanent loads (structure and equipment) is equal to zero.

- Deflection at deck ends :

The deflection between two decks, under usual combinations including temperature, shall be limited as follows (measured at running surface level):

- transversal deflection : 5 mm,
- longitudinal deflection : 150 mm,
- vertical deflection: 3 mm.

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4 STATIONS AND PRELIMINARY INFORMATION FOR STRUCTURAL DESIGN.

4.1 Typical station.

Typically the station houses, at the platform level, the platform edge protection and at the technical level the technical rooms.

Other equipment, not part of the system, such as escalators, elevators, automatic fare collection, ... require spaces and technical rooms according to local regulations.

4.2 Platform edge protection

4.2.1 Platform edge protection description

The platform edge protection, including emergency doors and platform doors holds in two purposes:

- Physically separate the platform where passengers stand awaiting for a train from the trackway.
- Allow passengers' transfer from the station platform to the vehicle only when the train is completely stopped with doors opened.

The platform edge protections are located on the edge of the station platform and are installed in such a manner that when a 26 m long train set, stops in a station, the six doors of the vehicles correspond face to face with the six platform doors.

The trackside of platform edge protection is located as close as possible to dynamic gauge of the vehicle, which determines the distance between the centreline of the track and the platform edge protection.

The height of platform edge protections is 2.63 m between the finish floor level of the station platform where the doors frame structure connects with the station structure. The free passage height is 1.965 m.

When a vehicle is stopped at the station within the acceptable range, each door provides a 1300-mm wide free opening for passengers' transfer from and to the station platform.

4.2.2 Design criteria for civil works.

- Bottom interface

A continuous block out along the platform edge 15 cm deep from the finish floor platform level and 35 cm wide from platform edge approximately must be provided to allow the installation of the steel base plates.

The tolerance on plate location is ±20 mm measured from the track centre line.

- Top interface:

Steel plates at 2.63 m high from the platform level and 3 m spacing average, must be provided to attach the top part of the structure

The tolerance on plate location is 0/+2 cm measured from the finished platform level.

- Platform centre line:

Openings or conduits in the station platform slab must provided for the wiring of the platform door control cabinet.

Attachment structure and plates are calculated to withstand loads due to the platform edge protection only.

The loads at each attachment points: 400 daN acting vertically downward, and 500 daN acting horizontally.

These data are for information only and are to be confirmed at a later stage.

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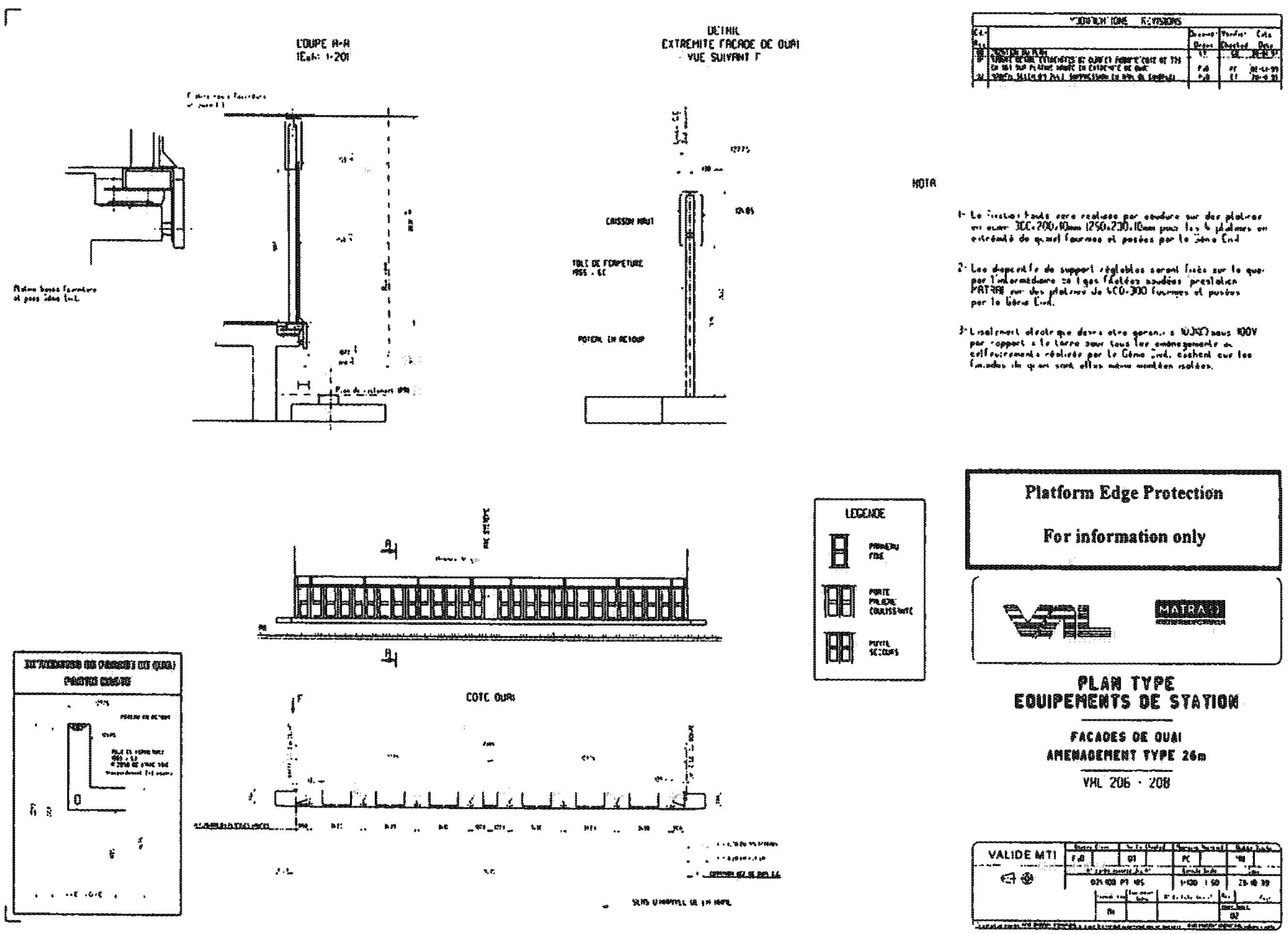

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4.3 System technical rooms

System technical rooms are mainly for power distribution supply, signalling and dwell operation control unit rooms.

The information provided hereby is indicative and must be confirmed during the project design.

4.3.1 Power Distribution Supply rooms.

4.3.1.1 Bulk Supply Substation – BSS.

The High Voltage to the system is supplied from the public network by means of Bulk Supply Substations, whose location need to be defined at a later stage.

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Location:	**Tbd**
Size:	**12.00 m x 4.50 m x 2.80 m high. Useful height**
Heat dissipated:	**3 kW.**
Fill in concrete:	**0.50 m high.**
Super imposed load:	**1 000 daN/m².**
Additional equipment:	• **2 power outlets,** • **2 telephone sockets.** • **Electric security set** • **IP 35 minimum**
Revetment	**Anti-dust concrete covering**
Metallic doors	**2x0.80x2.10** **1x1.60x2.50** **with safety bar**
Electricity	**Electric board 380V 3x32A+G** **Sockets 220V 2x16A+G**
Lighting	**200 LUX**
Ventilation	**YES**
Heating	**NO**
Fire	**Detection YES** **Fire fighting YES**
Phones Computer network	**YES** **NO**

4.3.1.2 Traction Power Substation – TPSS.

The power supply to the guidance rails is provided from the Traction Power Substations, in which the high voltage is converted into 750 VDC power.

Each TPSS is power supplied directly by the adjacent Facility Power Substation - FPSS - located in the same station. A HV distribution and protection cubicle with circuit breaker supplies and protects the 12-pulse transformer-rectifier unit directly from the FPSS.

Downstream of this unit, a two poles Manual Insulating Switch allows to insulate this unit from the downstream part of the distribution, so that maintenance can be carried out safely without disturbing the line operation.

The 750 VDC power is then brought to the contact rails through high-speed circuit breakers and 300 sq. mm one-pole feeder cables.

Location:	Tbd
Size:	• 9.00 m x 8.50 m x 3.20 m high usually, • 12.00 m x 11.00 m x 3.20 m high at depot. These dimensions are indicative only. They may be revised according to the configuration of adjacent rooms and access locations.
Heat dissipated:	15 kW.
Fill in concrete:	0.50 m high.
Super imposed load:	1500 daN/m² except for transformer, 10000 daN on four points.
Additional equipment:	• 1 equipment access door (2.10 m x 2.70 m), • 1 personnel access door, • Floor access traps for equipment transfer from the ground level (if no at-grade access) 3.00 m x 2.10 m dimensioned for the transformer (or platform on the ground in the case of an at-grade substation). • 2 telephone sockets, • 2 power outlets.
Special features:	• The transformers are installed using two guidance rails anchored in the fill-in concrete up to the level of access trap for underground sections, and to the end of the removal platform outside the room for TPSS located at-grade. • The transformer will be located inside the room, inside an area limited by a fence with an access door fitted with a padlock for restricted access. • Lifting appliance is required for handling the transformers when installing them and for maintenance operations.
Revetment Ceiling	Anti-dust concrete covering Insulation + watertightness
Metallic doors	3x0.80x2.10 1x1.60x2.50 and 1x1.60x2.80 with safety bar
Electricity	Electric board 380V 3x32A+G Sockets 220V 2x16A+G IP 30 minimum
Lighting	200 LUX
Ventilation	YES
Heating	NO
Fire	Detection YES Fire fighting YES
Phones Computer network	YES NO

4.3.2 Gap Breaker Substation – GBSS.

A general sectionalizing scheme divides the line and the depot area in various electrical sections in order to enable to separately energize sections.

Each boundary between two electrical sections is achieved by creating a neutral section long enough for the longest train overriding, keeping the de-energized section safe in any cases, while the rest of the line is operated.

The equipment running these boundaries is located in the Gap Breaker Substation (GBSS). When there is one TPSS in the station, TPSS and GBSS are in the same technical room.

Location:	**Tbd**
Size:	**4.50 m x 4.00 m x 3.60 m high.(for information only)**
Heat dissipated:	**10 kW.**
Fill in concrete:	**0.50 m high.**
Super imposed load:	**1500 daN/m2**
Revetment Ceiling	**Anti-dust concrete covering** **Insulation + watertightness**
Metallic doors	**3x0.80x2.10** **1x1.60x2.50 and 1x1.60x2.80** **with safety bar**
Electricity	**Electric board 380V 3x32A+G** **Sockets 220V 2x16A+G** **IP 30 minimum**
Lighting	**200 LUX**
Ventilation	**YES**
Heating	**NO**
Fire	**Detection YES** **Fire fighting YES**
Phones Computer network	**YES** **NO**

4.3.3 Facility Power Substation – FPSS.

Facility power substations supply the low voltage power in and around the stations to different services such as lighting, technical rooms, ventilation, elevators, AFC equipment, etc.

At each station and at the depot one main low voltage switchboard is receiving one 410 VAC feeder coming from the transformers being fed by one of the HV supply cables.

Location:	One FPSS in every station and at the depot. FPSS is located close in the station in such a position that links to other technical rooms are minimised, with an easy routing.
Size:	11.00 m x 5.00 m x 2.85 m high.(Useful height), in station 11.00 m x 6.50m (Useful height), in depot
Heat dissipated:	5 kW.
Fill in concrete:	0.50 m high.
Super imposed load:	1500 daN/m² (2000 daN for transformers on 4 points).
Special features:	The MV, LV and auxiliary boards are installed and mounted on metal frames and the transformers are supported by a concrete foundation in which two guide rails are anchored for the transformer rollers.
Revetment Ceiling	Anti-dust concrete covering Insulation + watertightness
Metallic doors	1x0.80x2.10 2x1.60x2.50 with safety bar
Electricity	Electric board 380V 3x32A+G Sockets 220V 2x16A+G IP 30 minimum
Lighting	200 LUX
Ventilation	YES
Heating	NO
Fire	Detection YES Fire fighting YES
Phones Computer network	YES NO

4.3.4 Uninterrupted Power Supply Rooms – UPSR.

Location:	Adjacent to the FPSS, an UPS room in each station and at the depot.
Size:	2.50 m x 2.50 m x 2.85 m high (minimum useful volume, which can be adapted to the configuration of the adjacent rooms).
Heat dissipated:	6 kW.
Fill in concrete:	0.30 m high minimum.
Super imposed load:	400 daN/m².
Special features:	• The batteries are of the scaled low-maintenance type. The room must be fitted out accordingly (see standards). • The CWC installs a separation wall between the batteries and the battery chargers.
Revetment Ceiling	Anti-dust concrete covering Insulation + watertightness
Metallic doors	1x0.80x2.10 2x1.60x2.50 with safety bar
Electricity	Electric board 380V 3x32A+G Sockets 220V 2x16A+G IP 30 minimum
Lighting	200 LUX
Ventilation	YES
Heating	NO
Fire	Detection YES

	Fire fighting YES
Phones Computer network	**YES** **NO**

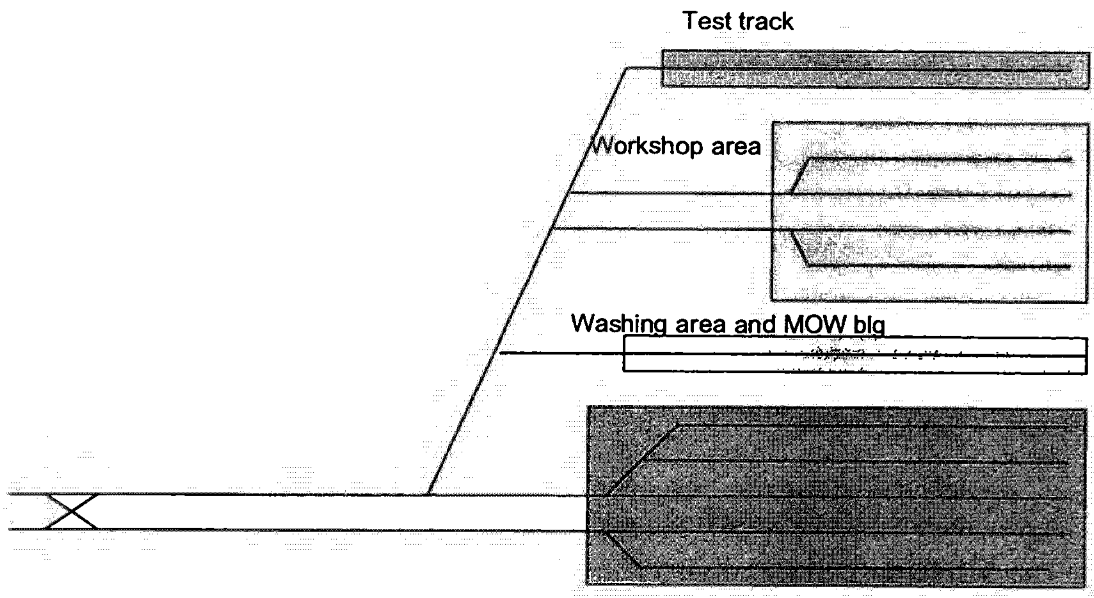
4.3.5 Signalling rooms.

ATC System equipment is housed in the Signalling Rooms.

Location:	One signalling room in each station, one at the depot, one next to the OCC.
Size:	**8.00x5.50 m x 2.70m (Useful height)**
Heat dissipated:	**5 kW.**
Fill in concrete:	**0.30 m high.**
Super imposed load:	**1000 daN/m².**
Revetment Ceiling	**Anti-dust concrete covering** **Insulation + watertightness**
Metallic doors	**1x0.80x2.10** **1x1.60x2.50** **with safety bar**
Electricity	**IP 535/549 minimum** **Sockets 220V 4x16A+G**
Lighting	**200 LUX**
Ventilation	**YES**
Heating	**NO**
Fire	**Detection YES** **Fire fighting YES**
Phones Computer network	**YES** **NO**

5 DEPOT

5.1 Typical Depot principle diagram



5.2 Description of the depot

The depot is designed to house the different functions to be implemented in order to keep the system in operation with the highest level of availability in accordance with the objectives of quality service and operating cost.

The missions of the depot are:

- Preventive and corrective maintenance of vehicles as well as larger servicing or preventive overhaul operations.
- Vehicles cleaning and washing,
- Maintenance and tests of the equipment of the wayside installations using specifically dedicated workshops,
- Storage of spare parts.

The auxiliary functions of the workshop consist in:

- Parking the Maintenance of way vehicle – MOW vehicle.
- Storage of vehicles.

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- Providing the necessary areas for the management and the organization of the maintenance operations.

In order to minimise the cost of construction, the Operation Control Centre is conveniently located in the Maintenance building:

- Central control room (OCC),
- Preparation rooms for the operating agents including operating offices, rest room, etc..
- Offices for the operating manager and foremen,
- Training-meeting room,
- Changing rooms and shower rooms at the first floor.

5.2.1 Space allocation

According to the STS experience, the constructed space requirements for the depot main areas are:

- Workshop, including the main workshop, specialised workshops, storage rooms: XX m².
- Offices, including the maintenance, operation and management offices, the meeting rooms and the Operation and Control Centre – OCC: XX m².
- Vehicles storage: from XX m²

Siemens Transportation Systems exclusive property

AR00085581

INFORMATION PACKAGE

VAL TECHNOLOGY CHARACTERISTICS

QUESTIONNAIRE

I-FUNCTIONALITY

1. Please provide a brief product description of your System, including any special guideway general arrangements, cross sections and technical details.

Please report to document "Val 208 System Preliminary Information"

2. Are there any limitations with your system providing the required level of service along the First Project's 20 mile route selected and station spacing adopted? If so, please explain.

Our System is compliant with the First Project System and Vehicle characteristics except the right-of-way speed limited to 50 mph.

3. Can your system carry a maximum of 9,000 pphpd during the peak periods? Please provide the number of vehicles per train, number of trains and headways for each case. Also identify the square feet per seated and standing passenger assumed.

Yes, our System can carry a maximum of 9,000 pphpd during the peak periods.

As a rough approach, this capacity requirement gives the followings results considering 4 standing passenger per m2 and 0,4m2 per seated passager :

	Nb of trains	Nb of vehicles per train	headways
Val System 2,08	48	2 double vehicle (4 cars)	110 sec.

4. Can your system deliver an average end-to-end travel time of 40 minutes for the First Project with a 20 second dwell time at each station?

Yes, these performance can be met.

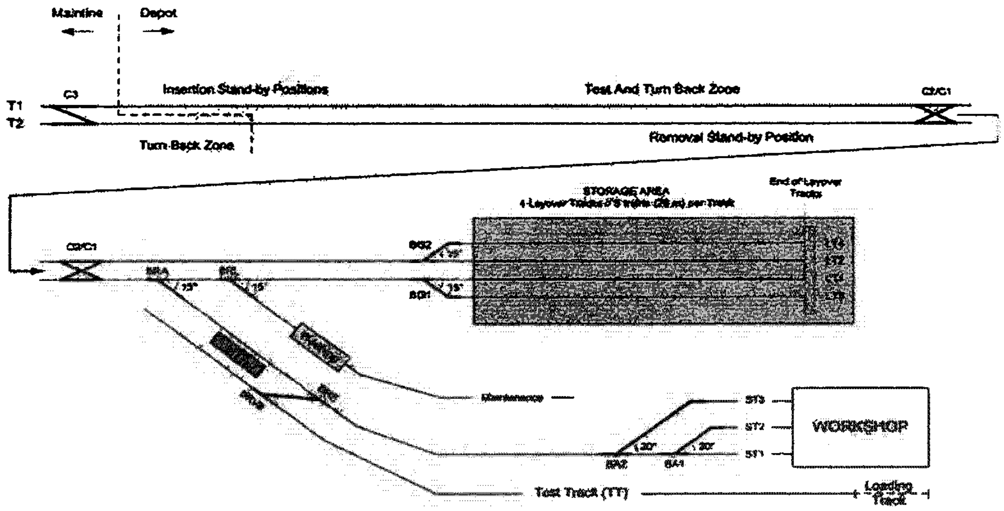
5. Can your System accommodate guideway switching and crossing over with 2 minute main line headways? If your System is other than a conventional rail technology, please provide details of the guideway switching apparatus (from an existing operating system) for both turnouts and crossovers, including general arrangement drawings, mechanism details and costs along with times to change routes.

Yes, our System accommodates guideway switching and crossing over with 2 minute main line headways.

For details, please report to the document "Val208 System Preliminary Information" on page 13.

6. If your system is other than a conventional rail technology. please provide a general layout and cross section of an existing storage yard and maintenance facility for a system of similar size and passenger loads.

Please find here-below an example of depot arrangement.



7. Can your system support future expansions and extensions?

Yes, Siemens Transportation Systems already experienced on expansion of E&M system on large APM (e.g. Lille_France (in 4 times), Toulouse_France (1 time) and Torino_Italy (1 time)), as well as upgrade of Control Centre either on the same location or elsewhere, and with the care to induce minimal or even no disruption to the revenue operation.

Here below are described an example of expansion plan

- Construction and testing of new guide-way, stations and equipment (including switches),
- Set up of the permanent M&SF
- Addition and testing of new trains
- Transformation of temporary M&SF to pocket track which will be able to store trains, and eventually able to provide some specific failure operating mode
- Commissioning

All guide-way equipment such as guidance rails, running and support surfaces, switches, buffers are designed in order to satisfy the requirements for maximum-length trains at the

Ultimate line capacities.

8. Can other manufacturers provide interoperable vehicles in a future procurement? If so, please provide the names of up to four other manufacturers of compatible equipment.

Val vehicles are today produced in Prag in the Czech Republic (EU). It is worth mentioning that Bombardier is able to produce similar cars fully compatible with the Val system. This was demonstrated in Taiwan with the Neihu extension of the Val Muzha line. These vehicles are currently being produced by Bombardier partially in Taiwan and partially in the US.

9. Can multiple manufacturer provide compatible interfacing Systems equipment in a future procurement? If so, please provide the names of up to four other manufacturers of compatible train control/signaling, traction power distribution, propulsion and braking control equipment.

As explained in question 8, Bombardier and other sub system providers such as Vossloh and Faiveley are providing vehicles, switches, trackway and other interfacing systems equipments fully compatible with the Val system.

10. Would your System comply with federal and state regulations and requirements, including the following?

- Americans with Disabilities Act (ADA);
- Buy America Act;
- Hawaii Seismic Codes;
- Fire Protection and safety evacuation regulations (including NFPA 130).

Yes, our company has wide experience of international standards (IEC, CCITT, CCIR, ISO), American standards (NFPA, ANSI, ASTM), European standards (EN or EU) and French standards (NFF).

Moreover, our System complies with the BAA, as Siemens is able to manufacture the vehicles from his own plant at Sacramento site.

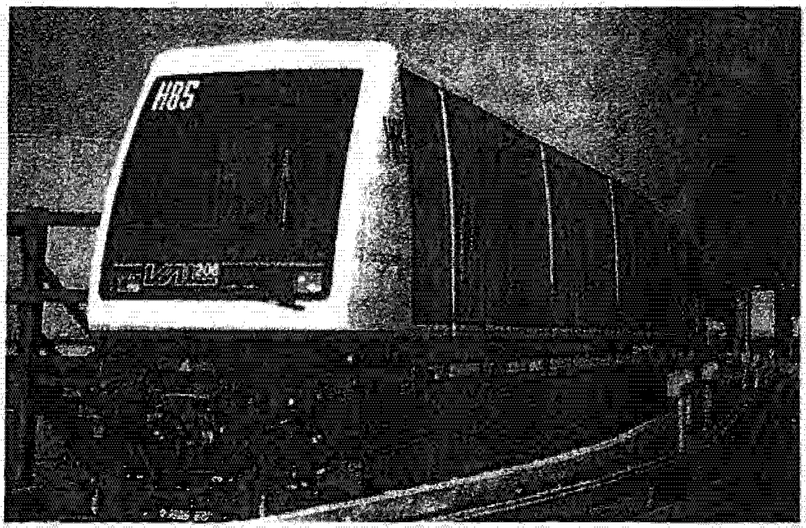
11. What features does your System offer which could reduce the impact of construction?

Val System presents an insertion facility, silence and lack of vibrations.

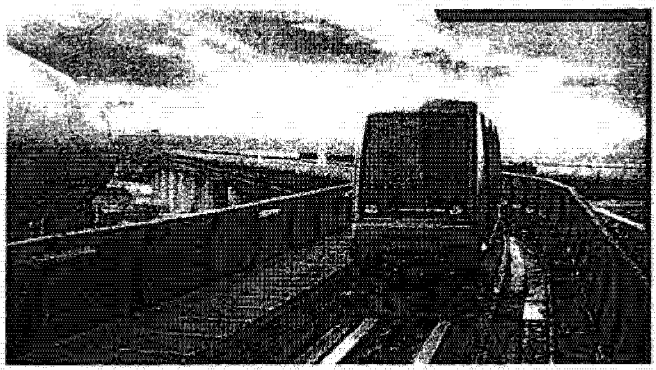
Compared to others systems, the infrastructure for Val System can be reduced in dimensions (thickness, large)

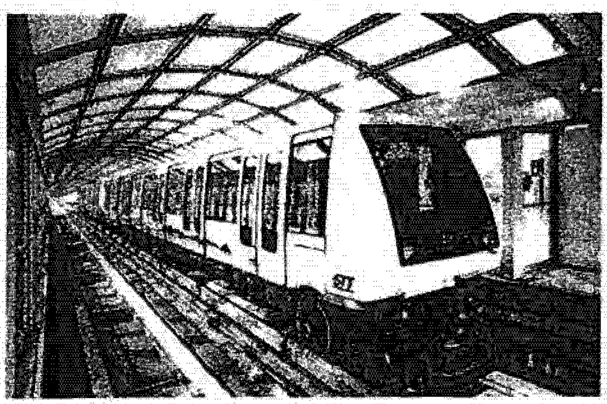
See cross section on page 18 in the document "Val208 System Preliminary Information"

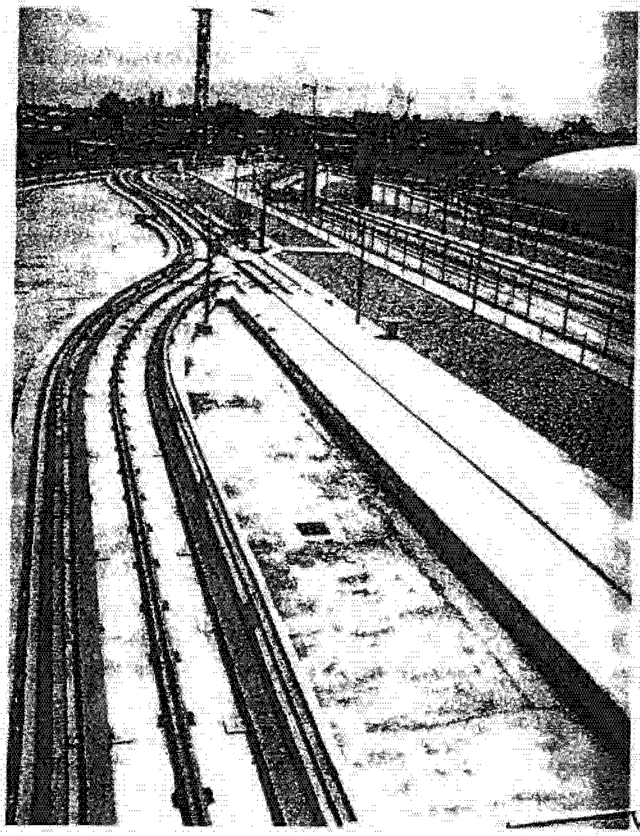
12. Provide high resolution digital photograph(s) of your proposed System and proposed vehicles which are currently in service that can be used in presentations and publicly released reports (do not provide artist renderings).



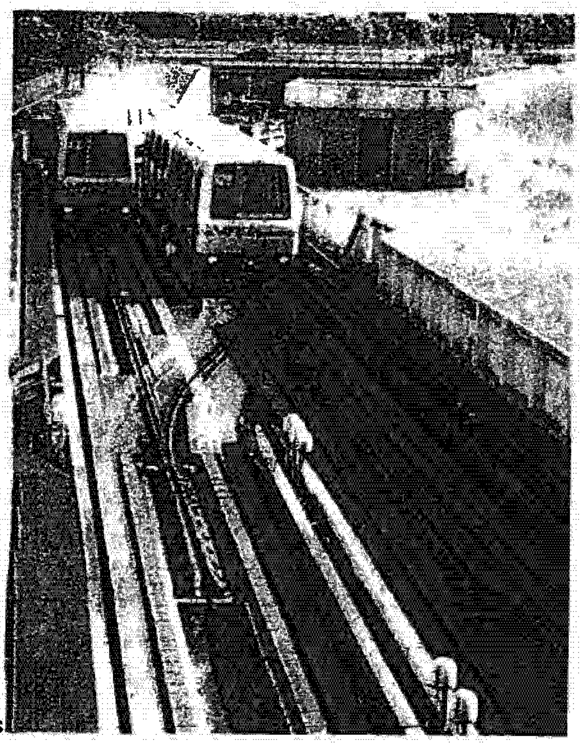
Val Vehicle







VAL track



Val Switches

13. If your System requires a proprietary guideway, please provide a typical list of quantities for piers, beams, walkways and guidance mechanisms for 450 linear feet of dual guideway with a clearance of 20 feet above ground level. (Assumptions should include 150-foot long spans).

No proprietary guideway is requested for our System. Generally, the guideway spans are designed at 25 to 30 meters (or 100 foot long) but it depends of viaduct calculations (as spans can be designed as iso-static or hyper-static spans)

14. Please provide information regarding actual costs of your vehicles and equipment for similar transit Systems recently built or in revenue service.

Here-below find contract value for our Systems in revenue service

Toulouse B	10,3 miles	20 stations	70 vehicles	: 262,5M€ (value 2000)
Torino	6 miles	15 stations	92 vehicles	: 230M€ (value 2000)
Rennes	5,8 miles	15 stations	32 vehicles	: 160M€ (value 1996)

Are there any unique costs or proprietary technology considerations associated with your technology (positive or negative)? Please explain:

As our technology solutions are completely well proven and protected by patent, no development costs are included in our prices.

Please tell us if your System would reduce the costs associated with right-of-way acquisition and/or reduce the impacts to traffic and the community when compared to an elevated 28 foot wide guideway built on single piers at approximately 150 foot spacing. Please explain:

Our system requires only an elevated 20 foot wide guideway which could reduce the costs associated with right of way acquisition.

III - TECHNOLOGICAL MATURITY

15. Has your proposed transit System been proven in revenue service for at least five years? Please provide information and local contacts regarding some of those locations.

Please, report to the document "Introduction" for maturity aspects.

1	Chicago Project	OATS (Operation and Maintanance Company - O'Hare Airport Transit System) North Cargo Road Building # 522 AMF O'HARE P.O Box 66511 Chicago Illinois 60666-0511 Mr. Rajkumar RAMBHAJAN Tel: +1 773 601 1800
2	Roissy Paris Project	ADP (Aéroport de Paris) 291 boulevard Raspail 75675 Paris cedex - France M. Cathelain Tel +33 1 43 35 70 00
3	Lille Projects	LMCU (Lille Metropole Communauté Urbaine) 1, rue du Ballon BP 749 59034 Lillle Cedex - France Mr Bernard GUILLEMINOT -Tel : + 33 3 30 21 22 23
4	Rennes Project	SEMTCAR (Société d'Economie Mixte de Transports Collectifs de l'Agglomération Rennaise) 22 avenue Janvier - 35012 Rennes Cedex - France Mr Guy MALBRANCKE-Tel : +33 2 99 85 89 30
5	Toulouse Projects	Société du Métro de l'Agglomération Toulousaine (SMAT) 1, place Esquirol BP 10416 – 31004 Toulouse Cedex 6 - France Mr Pascal GODON - Tel : + 33 5 61 14 48 50
6	Torino Project	GTT (Gruppo Torinese Trasporti S.p.A. Corso Turati 19/6 – 10128 Torino - Italy Mr FANTINI - Tel : +39 011 57641

16. Please provide the status of any regulatory approvals required or pending.

All VAL System documentation were approved by Safety Regulations and Commissions concerning existing systems in Chicago, Taïpei or in Europe.

17. Please describe to what extent your technology uses proven and recognized off-the-shelf components and sub-components, which have been used in transit applications with similar levels of performance and reliability.

Please report to document "Introduction"

Note also, that Central Control Center is based on standard off-the-shelf (COTS) hardware, software and TCP/IP communications.

18. Please describe the status of the engineering and detailed design of your transit System and identify any technology risks.

Siemens Transportation Systems has been the pioneer to develop and test a fully automated system in the early 80's in Lille and thus have a 25 years experience in this field.

No major developments, except the ones required for the specificities of the System Project are anticipated in the field of Automatic Train Control for software and hardware to benefit of the previous experiences.

The final selection of suppliers and subcontractors will take into account the main objective to limit as far as possible the needs for new developments. Therefore, no major new development is anticipated at this level.

19. How do you typically guarantee the long term availability of replacement vehicles, systems equipment, and spare parts, as well as software support?

We typically guarantee a long term availability of our components by sub-contracting equivalent or replaceable units to our suppliers for a period beyond the guarantee period.

Software versus are conserved such a way that in case of supplier bankruptcy, we could be able to recover all software program implemented in our sub system.

AR00085589

INFORMATION PACKAGE

VAL VEHICLE CHARACTERISTICS QUESTIONNAIRE

1. General:

• Electric propulsion:	YES		~~NO~~
• High floor:	YES		~~NO~~
• Fully automatic train operation (manual back-up)	YES		~~NO~~
• Bi-directional vehicles:	YES		~~NO~~
• Third rail or equivalent current collection:	YES		~~NO~~
• Dynamic braking:	YES		~~NO~~
Regenerative braking:	YES		~~NO~~
ADA compliant:	YES		~~NO~~
Level boarding:	YES		~~NO~~
• Crash worthiness compliant:	YES		~~NO~~
• Crash worthiness details provided:	YES		~~NO~~
• Fire performance to NFPA 130:	YES		~~NO~~
• Emergency evacuation provisions:	YES		~~NO~~
• Video monitoring and recording:	YES		~~NO~~
• Automatic vehicle location / VMS System:	YES		~~NO~~
• Vehicle life:	30	years	minimum
• Details of noise mitigation measures provided:	YES		~~NO~~
• Vehicle maintenance and diagnostic System:	YES		~~NO~~
High reliability / availability:	220	failure	Per million km
• Low mean time to repair:	30 mn	mean	time to repair
• Expected vehicle life:	30	years	minimum
• Automatic passenger counting system :	YES		~~NO~~
• Vehicle general arrangement drawings provided:	YES		~~NO~~
• Vehicle cross sections provided:	YES		~~NO~~
• Vehicle to guideway interface détails provided:	YES		~~NO~~
• Vehicle static clearance envelope provided:	YES		~~NO~~
• Vehicle dynamic clearance envelope provided:	YES		~~NO~~
• Vehicle length (over ends of vehicle):	85,7	ft.	Val
• Vehicle length (over extended couplers):	84,5	ft.	Val
• Vehicle width (maximum carbody):	6,83	ft.	Val

INFORMATION PACKAGE

VAL VEHICLE CHARACTERISTICS QUESTIONNAIRE

- Vehicle height (maximum): 12,06 ft. (Val)
- Maximum weight per vehicle (empty): 68560 lbs. (Val)
- Ergonomic design as specified: YES __ ~~NO~~

Performance:

• Maximum operating speed:	50	Mph	
• Maximum acceleration rate;	2,9	mphps	
• Service braking rate:	2,9	mphps	
• Emergency braking rate:	4,02	mphps	mini
• Minimum horizontal radius curve:	131	ft.	Val
• Minimum vertical radius curve:	3445	ft, crest	3445 ft, sag (Val)
• Maximum grade:	8	% for	450 ft. (Val)
• Maximum sustained grade:	7 %		

Passenger Accommodations:

- # of wheelchair spaces: 2 spaces or more

  Number of seats per car: 36 seats (tip-up seats may be included)
- Number of standees per car at design load of 4 passengers / m^2 (AW2): 100 Standees (Val)
- Total number of passengers per car (seated + standees) at AW2 design load: 136 total passengers (Val)
- Air conditioned: YES ~~NO~~
- PA system with auto-announcer: YES ~~NO~~
- Passenger to OCC communications: YES ~~NO~~
- Destination and passenger information displays: YES ~~NO~~

Train Sets:

- Capable of coupling to make multicar trains: YES ~~NO~~
- Capable of failed train retrieval: YES ~~NO~~
- Capable of bidirectional operation from each car: YES ~~NO~~

INFORMATION PACKAGE

VAL SYSTEM CHARACTERISTICS QUESTIONNAIRE

1. Superelevation Limits

What are the superelevation requirements of your System?

Please explain:

Our System accepts a 12%.

2. Route Geometric Constraints

Does your system meet the following criteria? YES

- Minimum horizontal radii:
  - Maintenance Facility: 150 ft.;
    Elevated Structure: 400 ft.
- Minimum horizontal lengths:
  - Curves: 100 ft.;
  - Tangents: 100 ft.;
  - Spirals: 100 ft.
- Vertical alignment:
  - Maximum station grade: 1%;

If not, please explain:

3. Hours of Operation:

Does your System meet the following?

- 4:00 a.m. to 12:00 a.m. service day;
- 6:00 a.m. to 9:00 a.m. morning peak;
- 3:00 p.m. to 6:00 p.m. evening peak.

YES ~~NO~~

4. Station Dimensions:

> Platform length: 300 ft. maximum; with all doors on platform?

YES ________ ~~NO~~,

For information, with a 4-cars Val vehicles, length of 170 ft. is sufficient for station platform.

If not, please explain:

5. Emergency Evacuation Walkways:

Does your System meet ail of the following criteria?

- Must be along entire guideway;
- Must be accessible from vehicle;
- Minimum evacuation walkway width: 2'-6";
- Minimum evacuation walkway height: 6'-8";
- Minimum maintenance walkway width: 2'—0";
- Minimum maintenance walkway height: 6'-8";
- Walkway width is clear of the vehicle dynamic envelope;
- Walkway around switches meet state and local requirements.

YES ________ ~~NO~~.

See cross section in the document "Val 208 System Preliminary Information" for Emergency Evacuation Surfaces.

If not, please explain:

6. Traction Power:

> Power: Please provide Voltage and Distribution Configuration;

- Substation spacing __ 6500 ft.around
- Substation size: 2 MW.

Facility Power Sub Station (FPSS) are located in each station where the High Voltage is converted into 400V for the Low Voltage of stations.
The Traction Power Sub Station (TPSS) are located alongside the tracks where the High Voltage is converted and rectified to 750VDC for traction power.

AR00085593

7. **Train Control / Signal System:**

Can your System be supplied with a bi-directional fully automatic train operation with manual back-up?

YES ~~NO~~

If not, please explain:

Please provide examples of existing installations in revenue service:

Chicago and Roissy Charles de Gaulle (France) are equipped with ATP functions carried out by OBCU and WCU, ATO functions and ATS System.

8. **Communications:**

• Radio System:	YES	~~NO~~
• Passenger communication system to OCC/ Operators :	YES	~~NO~~
• On-board Closed Circuit Télévision:	YES	~~NO~~
• Fire & emergency management system:	YES	~~NO~~
• On-board ADA message system:	YES	~~NO~~

9. Noise **and Vibration:**

- Can your system meet or exceed the levels and criteria as established by the FTA *Transit Noise and Vibration Impact Assessment Guidance Manual* and the goal of 75 dBA at stations?

YES _______ ~~NO~~ _______

Please explain how this is achieved:

The speed and braking programs are adjusted during the phases of vehicles entrance and departure from the stations.

If not, please explain:

What noise level is achieved from your system operating on elevated guideway at 55 mph, measured 50 feet from the guideway centerline?

We covered a noise level of 74 dBA (Leq5s) at 37mph, measured at 50 feet from the guideway.

Cite a location where such a level can be measured:

Roissy Charles de Gaulle-Paris, Toulouse line B (France) and Torino (Italy) are in operation.

10. **Other Characteristics:**

Does your System provide the following?

- Fully accessible and meets all ADA requirements, including the regulatory requirements of 49 CFR Part 38, Transportation for Individuals with Disabilities;
- Meets all Buy America requirements; and
- Cost-effective to operate and maintain.

YES________ ~~NO~~________

If not, please explain:

____

____

Please explain how cost-effectiveness is achieved:

Siemens Transportation Systems is involved at more or less level of responsibilities and financial participation in the O&M Companies for the Operation & Maintenance of several VAL systems throughout the world:

- Lille – France.
- Orly Airport – France.
- Toulouse – France.
- Chicago O'Hare Airport – USA.

Although Siemens Transportation Systems is not an O&M Company, it has an intensive experience in Operation and Maintenance through strategic alliances with O&M Companies as well as sub-contractor for specific activities related to the VAL 208 System.

Siemens Transportation Systems' approach relies on a continuous communication between design, construction and operations and maintenance phases to make insure the E&M project to end and the O&M concession to start in due time with the best opportunity of success

The success of the VAL Systems in operation in the world rely on the quality of its design and implementation, but also on the safety and the efficiency of its operation. Significant traffic increases from the revenue service start-up, such as +30% in Toulouse, +100% in Lille, or +30% in Orly and an absolute safety level - half a billion passengers transported without any passenger injury, is the key-success for the Operation and Maintenance of the VAL 208 of the Uijongbu Light Rail Construction Project.

AR00085595

As an experienced company in the O&M business, Siemens Transportation Systems is therefore qualified to propose herein the basis of the Operation and Maintenance Plans.

The Operations and Maintenance Departments are under a single or several Departments responsibility with Senior Operations and Maintenance Managers.

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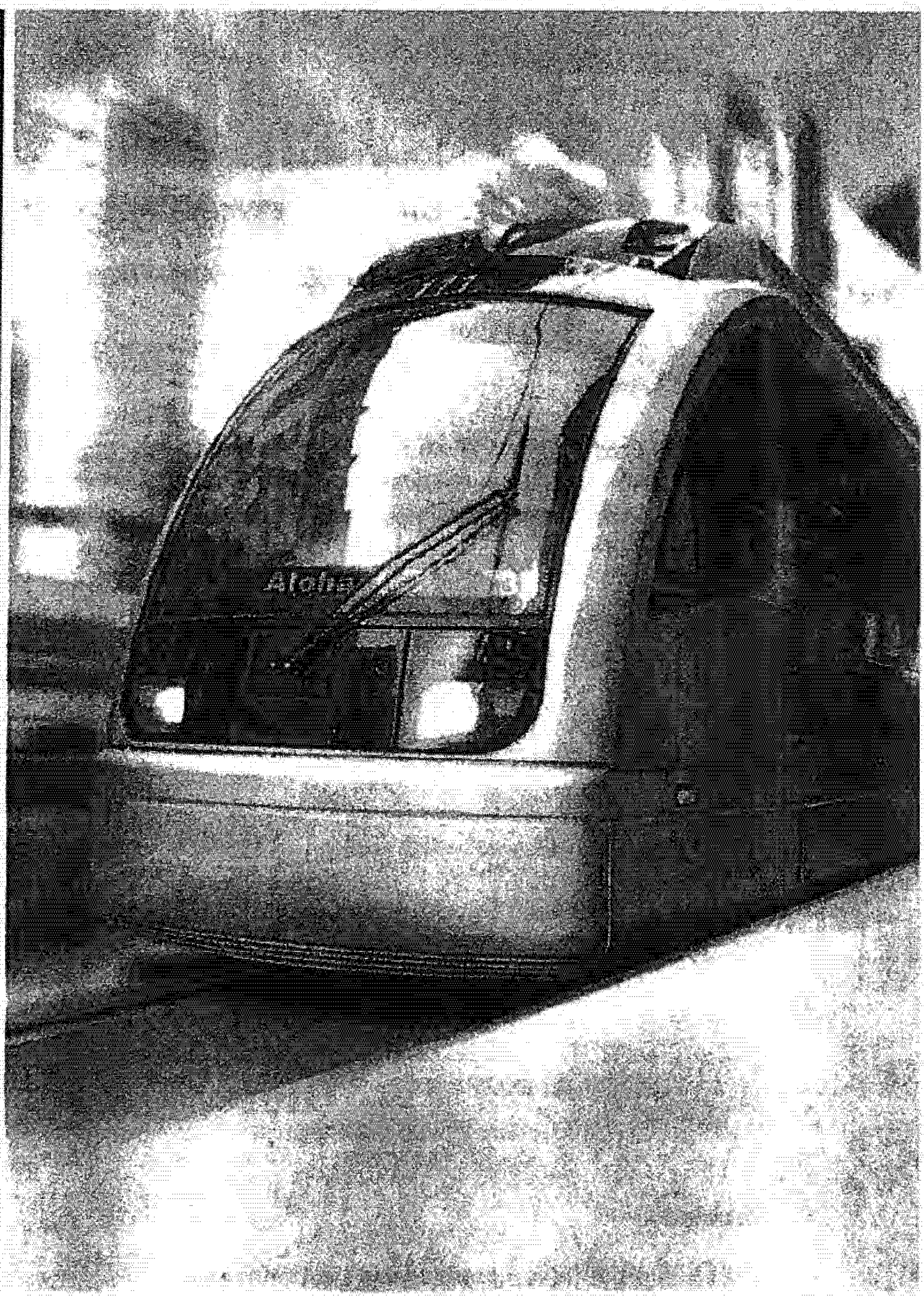
Siemens VAL



SIEMENS

Honolulu Transit

SIEMENS TRANSPORTATION SYSTEMS, INC.

RESPONSE TO REQUEST FOR INFORMATION (RFI 001)

January 24 2008

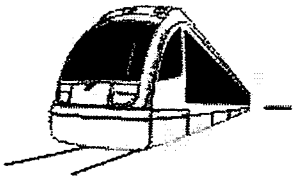
SIEMENS

HONOLULU HIGH-CAPACITY TRANSIT CORRIDOR PROJECT

RESPONSE TO REQUEST FOR INFORMATION (RFI 001)

Introduction

STS is pleased to provide the following response to request for information from the City and County of Honolulu in support of the technical studies in preparation the Environmental Impact Statements (EISs) for the Honolulu High-Capacity Transit Corridor Project (HHCTCP).



Request for information (RFI 001)
Submittal requirements - respondent contact information

Siemens's Designated Representative:

Mr. Steve Roescher
Siemens Transportation Systems Inc.
7810 Shaffer Parkway, Suite 100, Littleton, CO 80127
Telephone: (303) 568-7318, Mobile: (303) 503-0398
steve.roescher@siemens.com

Content:

- RFI Submittal Requirements and Questionnaires
- Attachments:
    - Crash worthiness details
    - Details of noise mitigation measures
    - Vehicle general arrangement drawings
    - Vehicle cross sections
    - Vehicle to guideway interface detail
    - Vehicle static clearance envelope
    - Vehicle dynamic clearance envelope
    - S70 Vehicle datasheets and high resolution images

Honolulu Transit

SIEMENS TRANSPORTATION SYSTEMS, INC.
RESPONSE TO REQUEST FOR INFORMATION (RFI 001)

SIEMENS

Bi-directional, six-axle, low floor articulated light rail vehicle constructed of low alloy high tensile (LAHT) steel and composite materials.

Low floor area comprises 70% of the interior and extends between the end trucks through the articulated center section.

Modern, spacious interior ensuring maximum visibility and safety. Enhanced interior air conditioning to accommodate local climatic conditions. Seating is primarily knee-to-back.

Eight sliding-plug passenger doors, four per side directly across from one another and located in the low floor area.

Equipped with a hydraulic height control system to permit level boarding and meet ADA requirements.

Modern passenger information system consisting of automated announcements, public address, passenger-operator intercom and electronic destination signs, as well as an interior and exterior vehicle surveillance system.

Propulsion is provided by a modern, state-of-the-art AC-IGBT system, with four motors per car, pulse controlled inverters and microprocessor vehicle control logic. Electro-hydraulic friction braking is provided with track brakes on all trucks.

Performance and Capacity		
Maximum operational speed:	66 mph	106 km/h
Maximum allowable speed:	71.5 mph	120 km/h
Service acceleration and deceleration:	3.0 mphps	1.34 m/s²
Emergency braking rate:	4.9 mphps	2.2 m/s²
Passenger capacity:	68 seats	
	Approx. 230 total passengers	
	4 wheelchair spaces and 2 bicycle racks	
Maximum operational gradient:	7%	
Motor power rating:	174 hp x 4	130 kW x 4
Catenary supply voltage:	750 Vdc	

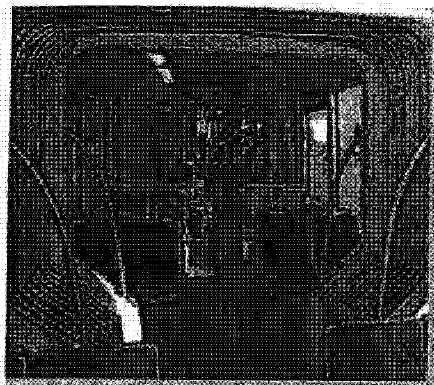
S70 Light Rail Vehicle

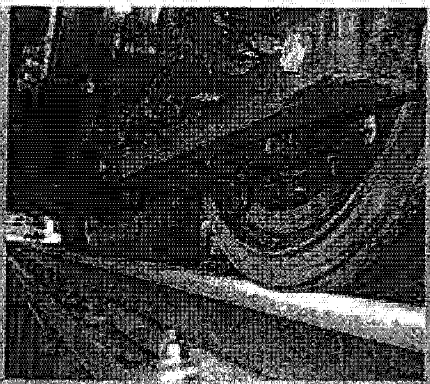
Charlotte, North Carolina

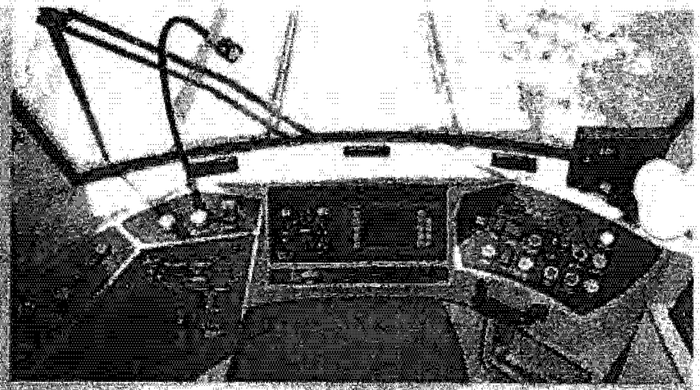
Transportation Systems

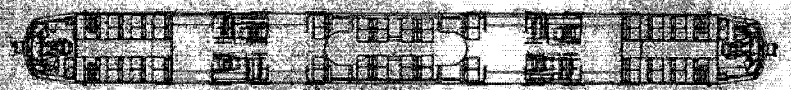
SIEMENS

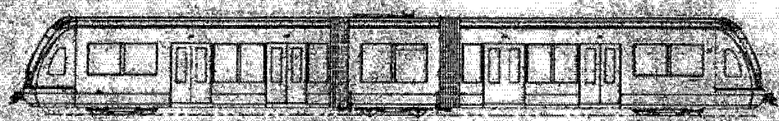
AR00085602

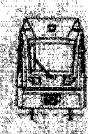












Vehicle Dimensions and Weight		
Length over coupler:	93.6 ft	28528 mm
Width:	8.7 ft	2650 mm
Height with pantograph (locked down):	12.7 ft	3870 mm
Maximum pantograph height:	up to 23 ft	7010 mm
Vehicle empty weight:	96800 lbs (AW0)	43908 kg
High floor secion above TOR:	2.2 ft (with 1 step plus slight ramp)	669 mm
Low floor section above TOR:	1.2 ft (threshold)	356 mm (threshold)
	1.3 ft (center)	396 mm (center)
Minimum turning radius:	82 ft	25 m
Vertical curve, crest:	820 ft	250 m
Vertical curve, sag:	1150 ft	350 m
Track gauge:	4.7 ft	1435 mm
Wheel base:	6.2 ft (power trucks)	1900 mm (power trucks)
	5.9 ft (center truck)	1800 mm (center truck)

Siemens Transportation Systems, Inc.
7464 French Road
Sacramento, CA 95828
U.S.A.

Rail Automation Division,
Traction Electrification Division
and Rolling Stock Division

www.usa.siemens.com/transportation

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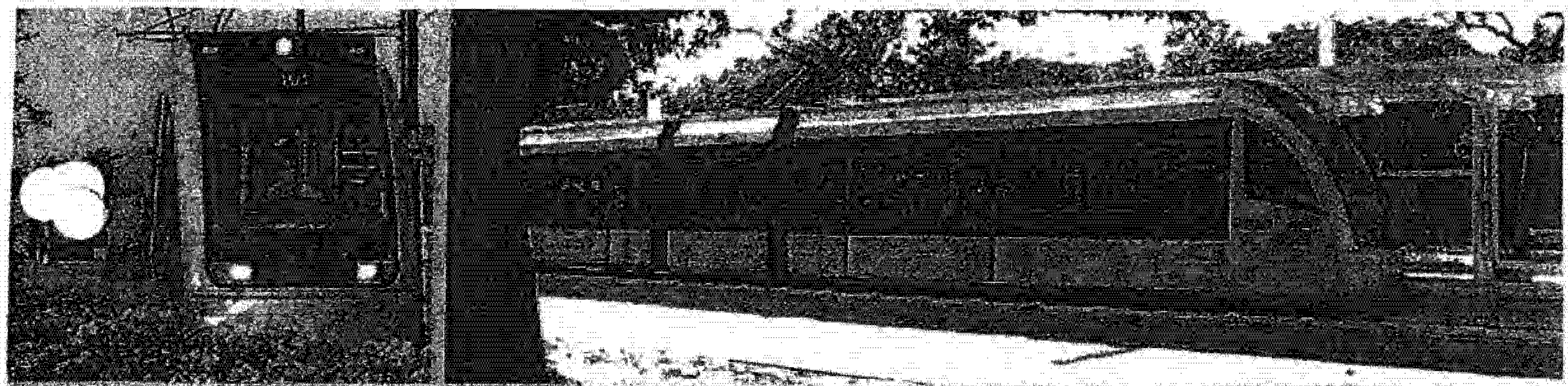


Bi-directional six-axle, low floor articulated light rail vehicle constructed of low alloy high tensile (LAHT) steel and composite materials with concealed couplers.

Low floor area comprises 70% of the interior and extends between the end trucks through the articulated center section.

Modern, spacious interior ensuring maximum visibility and safety. Enhanced interior air conditioning to accommodate local climatic conditions. Seating is primarily knee-to-back.

Eight sliding-plug passenger doors, four per side directly across from one another and located in the low floor area.

Equipped with a hydraulic height control system to permit level boarding and meet the requirements of the Americans with Disabilities Act (ADA).

Modern passenger information system consisting of automated announcements, public address, passenger-operator intercom and electronic destination signs, as well as an interior and exterior vehicle surveillance system.

Vehicle delivered with train-wayside communication (TWC) equipment and an event recorder.

Propulsion is provided by a modern, state-of-the-art AC-IGBT system, with four motors per car, pulse controlled inverters and microprocessor vehicle control logic. Electro-hydraulic friction braking is provided.

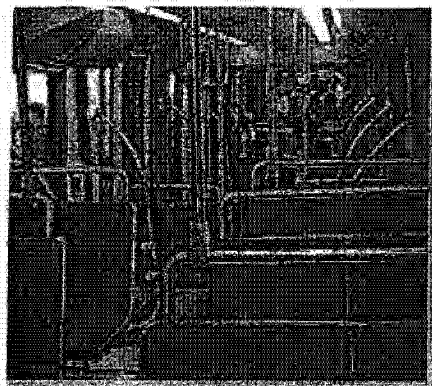
Performance and Capacity		
Maximum operational speed:	66 mph	106 km/h
Maximum allowable speed:	71.5 mph	120 km/h
Service acceleration and deceleration:	3.0 mphps	1.34 m/s²
Emergency braking rate:	4.9 mphps	2.2 m/s²
Passenger capacity:	72 seats	
	Approx. 241 total passengers	
	4 wheelchair spaces	
Maximum operational gradient:	7%	
Motor power rating:	174 hp x 4	130 kW x 4
Catenary supply voltage:	750 Vdc	

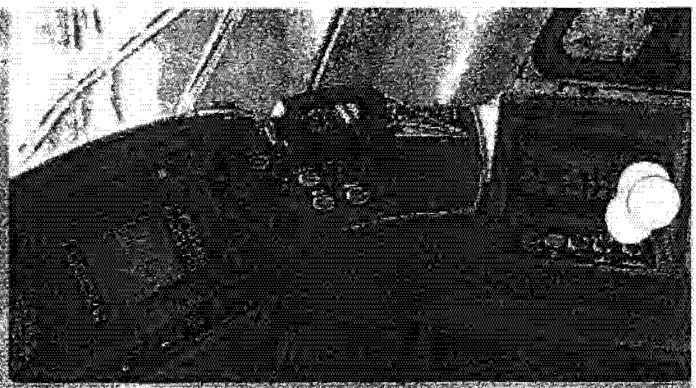
S70 Light Rail Vehicle

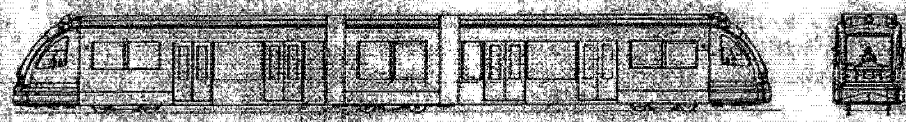
Houston, Texas

Transportation Systems

SIEMENS







Vehicle Dimensions and Weight		
Length over coupler:	96.4 ft	29370 mm
Width:	8.7 ft	2650 mm
Height with pantograph (locked down):	12.7 ft	3870 mm
Maximum pantograph height:	up to 23 ft	7010 mm
Vehicle empty weight:	98500 lbs (AW0)	44679 kg
High floor section above TOR:	2.2 ft (with 1 step plus slight ramp)	669 mm
Low floor section above TOR:	1.2 ft (threshold)	356 mm (threshold)
	1.3 ft (center)	396 mm (center)
Minimum turning radius:	82 ft	25 m
Vertical curve, crest:	820 ft	250 m
Vertical curve, sag:	1150 ft	350 m
Track gauge:	4.7 ft	1435 mm
Wheel base:	6.2 ft (power trucks)	1900 mm (power trucks)
	5.9 ft (center truck)	1800 mm (center truck)

Siemens Transportation Systems, Inc.
7464 French Road
Sacramento, CA 95828
U.S.A.

Rail Automation Division, Traction Electrification Division and Rolling Stock Division

www.usa.siemens.com/transportation

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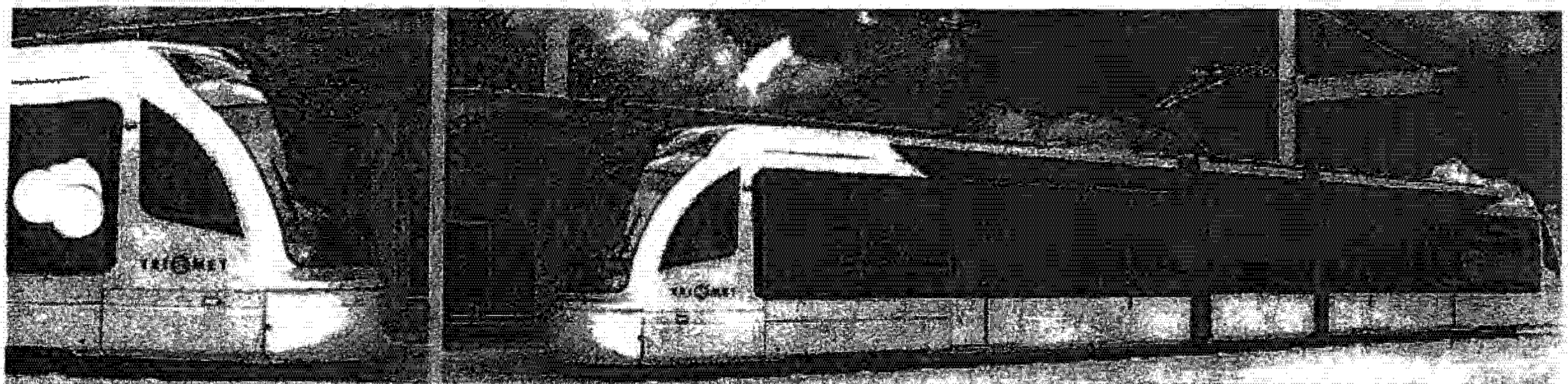


Six-axle, low floor articulated light rail vehicle with one active and one parlor cab. Designed for a two-car consist operation. The vehicle is constructed of low alloy high tensile (LAHT) steel and composite materials with concealed couplers.

Low floor area comprises 70% of the interior and extends between the end trucks through the articulated center section.

Modern, spacious interior ensuring maximum visibility and safety. Enhanced interior air conditioning to accommodate local climatic conditions. Seating is primarily knee-to-back. Parlor cab configuration provides additional passenger carrying capacity.

Eight sliding-plug passenger doors, four per side directly across from one another and located in the low floor area. Equipped with a bridgeplate to permit level boarding and meet ADA requirements.

Modern passenger information system consisting of automated announcements, public address, passenger-operator intercom and electronic destination signs, as well as an interior and exterior vehicle surveillance system.

Vehicle delivered with train-wayside communication (TWC) equipment, Automatic Train Stop (ATS) and an event recorder.

Propulsion is provided by a modern, state-of-the-art AC-IGBT system, with four motors per car, pulse controlled inverters and microprocessor vehicle control logic. Electro-hydraulic friction braking is provided.

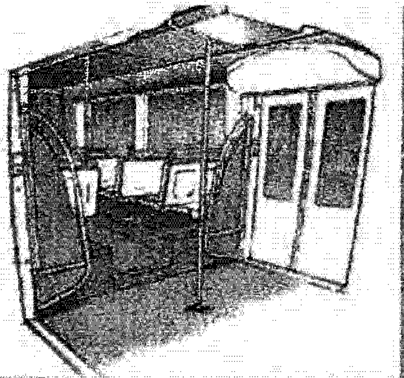
Performance and Capacity		
Maximum operational speed:	55 mph	88.5 km/h
Maximum allowable speed:	71.5 mph	120 km/h
Service acceleration and deceleration:	3.0 mphps	1.35 m/s²
Emergency braking rate:	4.9 mphps	2.23 m/s²
Passenger capacity:	72 seats	
	Approx. 228 total passengers	
	4 wheelchair spaces and 4 bicycle racks	
Maximum operational gradient:	7%	
Motor power rating:	174 hp x 4	175 kW x 4
Catenary supply voltage:	750 Vdc	

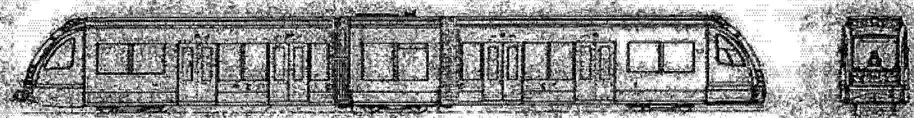
S70 Light Rail Vehicle

Portland, Oregon

Transportation Systems

SIEMENS





Vehicle Dimensions and Weight		
Length over coupler:	96.4 ft	28020 mm
Width:	8.7 ft	2650 mm
Height with pantograph (locked down):	12.7 ft	3870 mm
Maximum pantograph height:	up to 23 ft	7010 mm
Vehicle empty weight:	99500 lbs (AW0)	48988 kg
High floor section above TOR:	2.2 ft (with 1 step plus slight ramp)	669 mm
Low floor section above TOR:	1.2 ft (threshold)	356 mm (threshold)
	1.3 ft (center)	396 mm (center)
Minimum turning radius:	82 ft	25 m
Vertical curve, crest:	820 ft	250 m
Vertical curve, sag:	1150 ft	350 m
Track gauge:	4.7 ft	1435 mm
Wheel base:	6.2 ft (power trucks)	1900 mm (power trucks)
	5.9 ft (center truck)	1800 mm (center truck)

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Bi-directional, six-axle, low floor articulated light rail vehicle constructed of low alloy high tensile (LAHT) steel and composite materials.

Low floor area comprises 70% of the interior and extends between the end trucks through the articulated center section.

Modern, spacious interior ensuring maximum visibility and safety. Passenger interior air conditioning and heating to accommodate to local climatic conditions. Seating is primarily knee-to-back.

Eight sliding-plug passenger doors, four per side directly across from one another and located in the low floor area. Four doorways equipped with automatic movable bridge-plates meeting ADA requirements.

Modern passenger information system consisting of automated announcements, public address, passenger-operator intercom and electronic destination signs.

Vehicle delivered with train-wayside communication (TWC) equipment.

Propulsion is provided by a modern, state of the art AC-IGBT system, with four motors per car, pulse controlled inverters and microprocessor vehicle control logic. Dynamic and hydraulic friction brakes are provided, as well as track brakes.

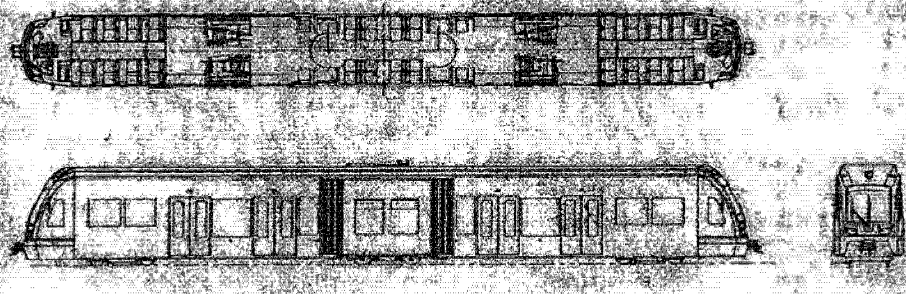
Performance and Capacity		
Maximum operational speed:	55 mph	88.5 km/h
Maximum allowable speed:	71.5 mph	120 km/h
Service acceleration and deceleration:	3.0 mphps	1.34 m/s²
Emergency braking rate:	5.21 mphps	2.33 m/s²
Passenger capacity:	64 seats	
	Approx. 221 total passengers	
	4 wheelchair spaces and 2 bicycle racks	
Maximum operational gradient:	6%	
Motor power rating:	174 hp x 4	130 kW x 4
Catenary supply voltages	600 Vdc	

S70 Light Rail Vehicle

San Diego, California

Transportation Systems

SIEMENS



Vehicle Dimensions and Weight		
Length over coupler:	90.7 ft	27670 mm
Width:	8.7 ft	2650 mm
Height with pantograph (locked down):	12.7 ft	3870 mm
Maximum pantograph height:	up to 23 ft	7010 mm
Vehicle empty weight:	95700 lbs (AW0)	43409 kg
High floor section above TOR:	2.2 ft (with 1 step plus slight ramp)	669 mm
Low floor section above TOR:	1.3 ft (center)	396 mm (center)
	1.2 ft (threshold)	356 mm (threshold)
Minimum turning radius:	82 ft	25 m
Vertical curve, crest:	820 ft	250 m
Vertical curve, sag:	1150 ft	350 m
Track gauge:	4.7 ft	1435 mm
Wheel base:	6.2 ft (power trucks)	1900 mm (power trucks)
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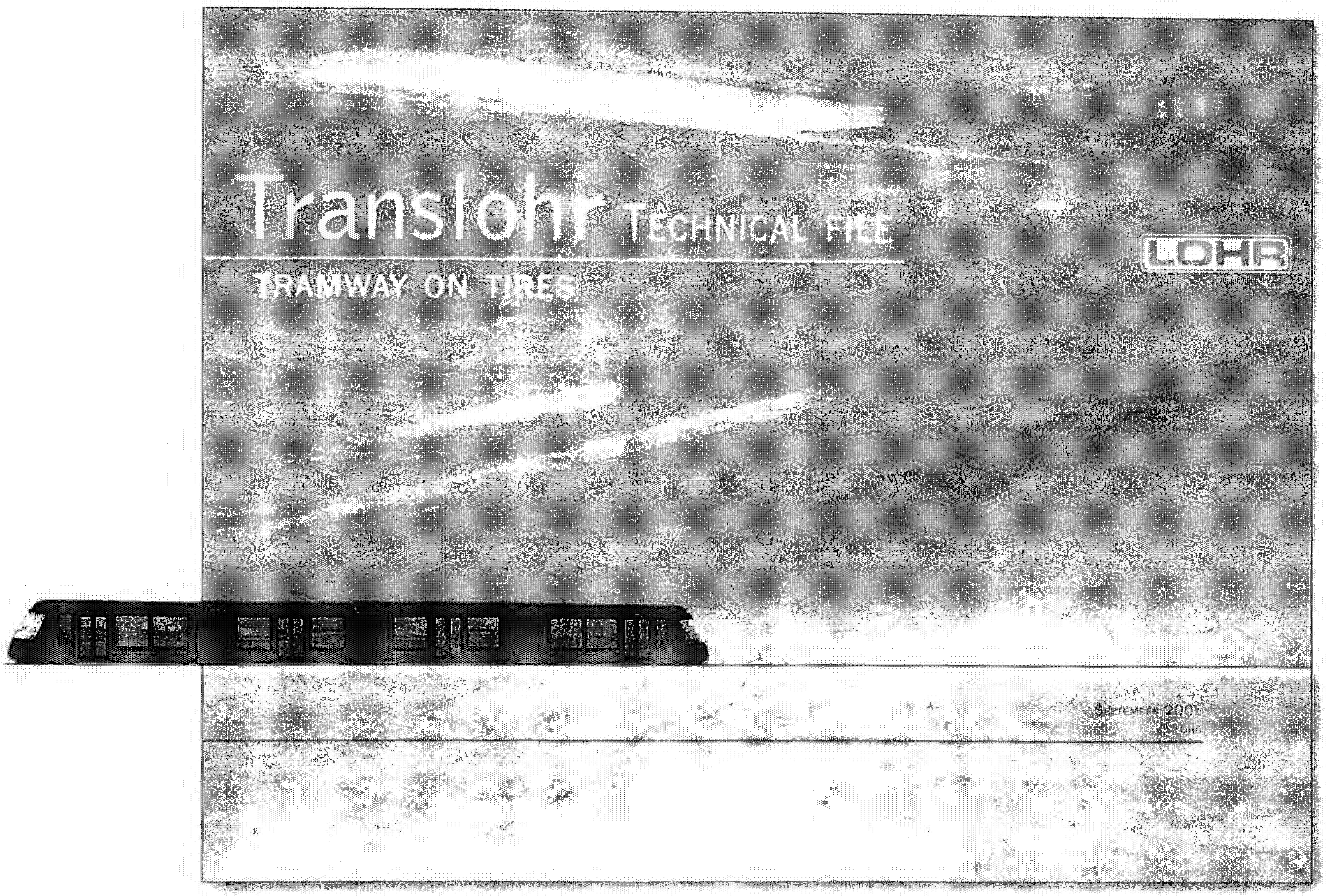
Translohr

Translohr

Brochure submitted- not responsive to RFI, and therefore not evaluated by the Technology Selection Panel



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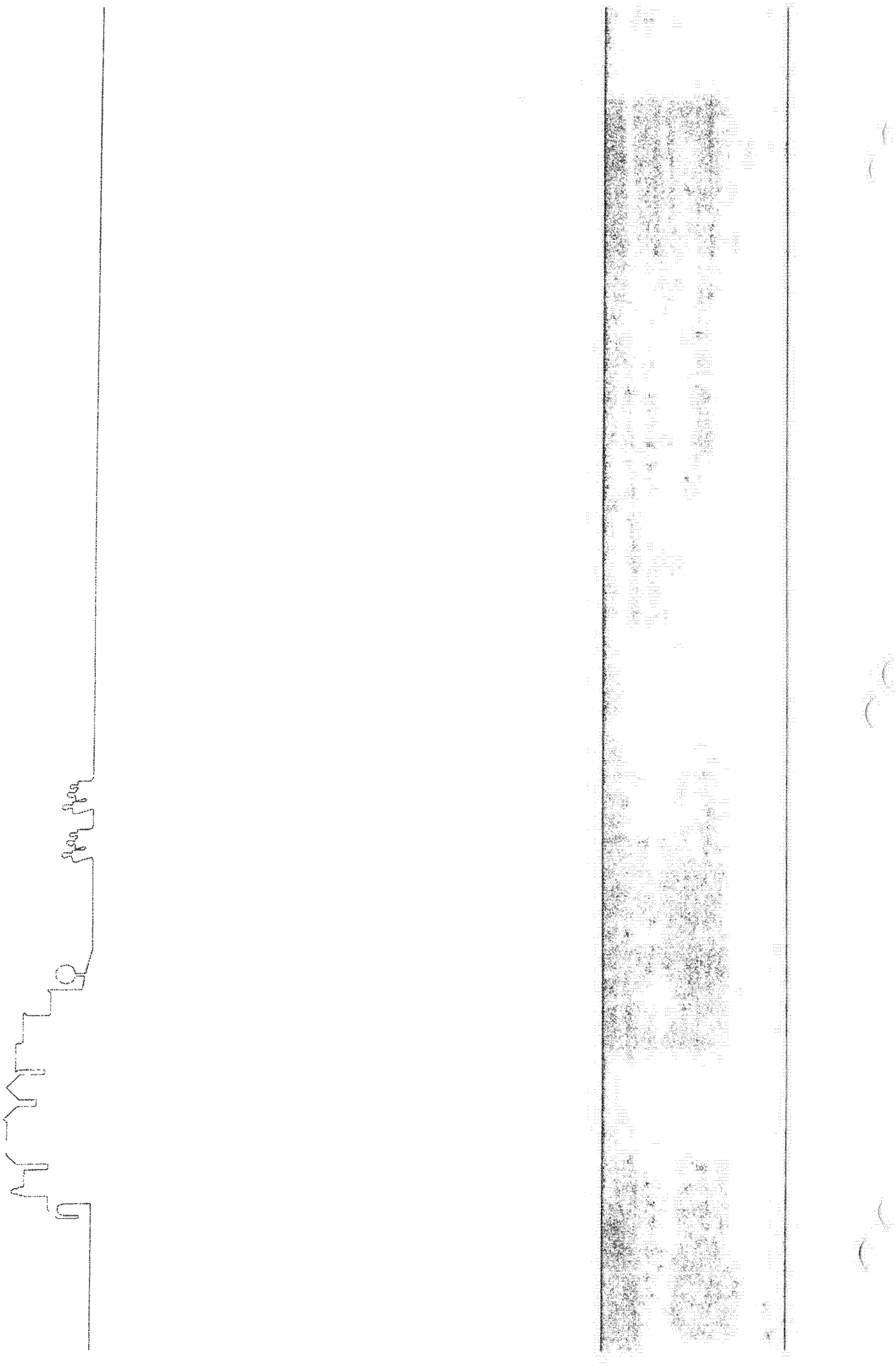

SYNOPSIS

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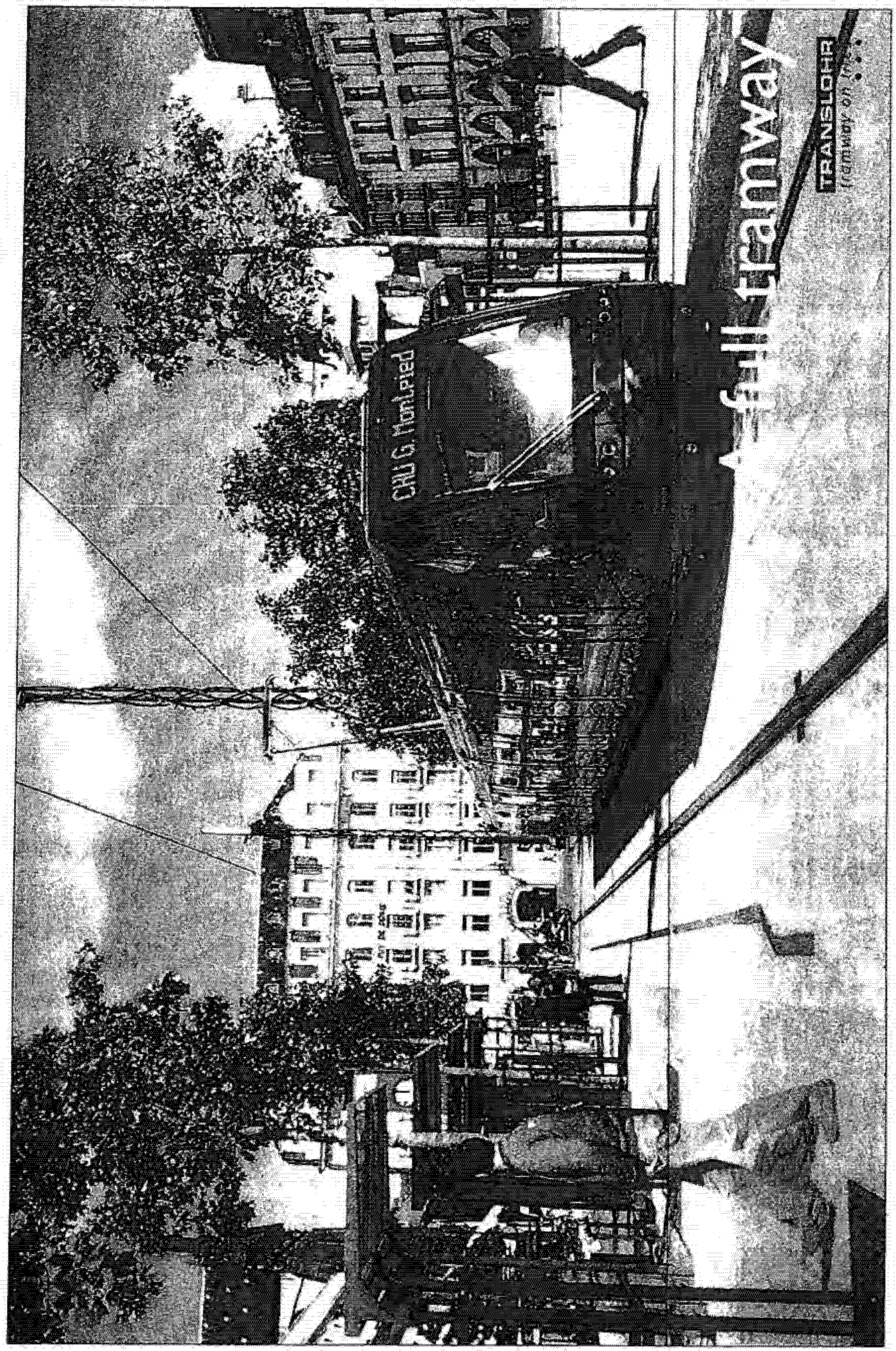
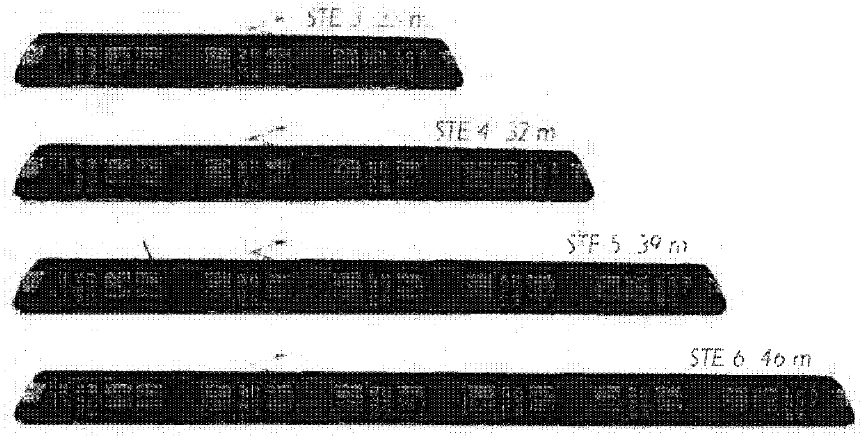

full tramway
TRANSLOHR
CHU G. Montpied

Number of passengers

4p/m²	6p/m²
127	178
170	238
213	298
255	358



■ Large transport capacity

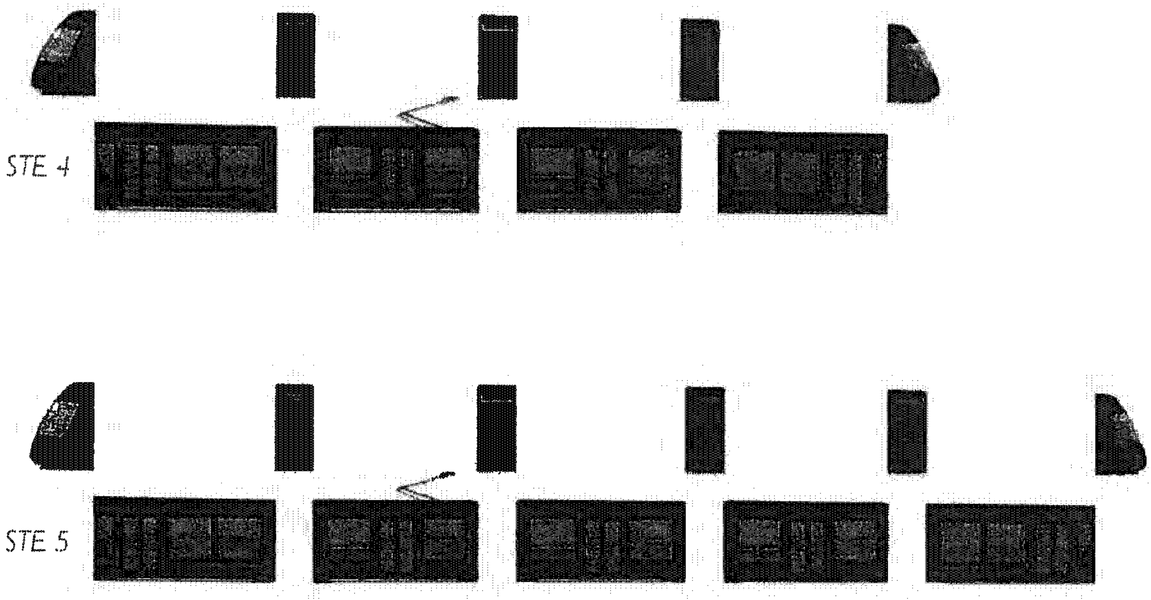
Translohr provides a complete range of vehicles, from 25 to 46 m.

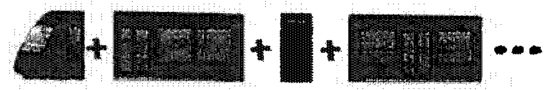
Translohr can also be coupled by 2, to provide a greater flexibility according to the transport demands during the day (slack periods or peak hours).

A full tramway Capacity

TRANSLOHR tramway on tires

AR00085616





■ ***Designed in standard modules: cabin, passenger module, connecting module***

The desired configuration is obtained by assembling the different modules, from 3 (STE3) to 6 (STE6).

A full tramway

Modularity

TRANSLOHR
tramway on tires

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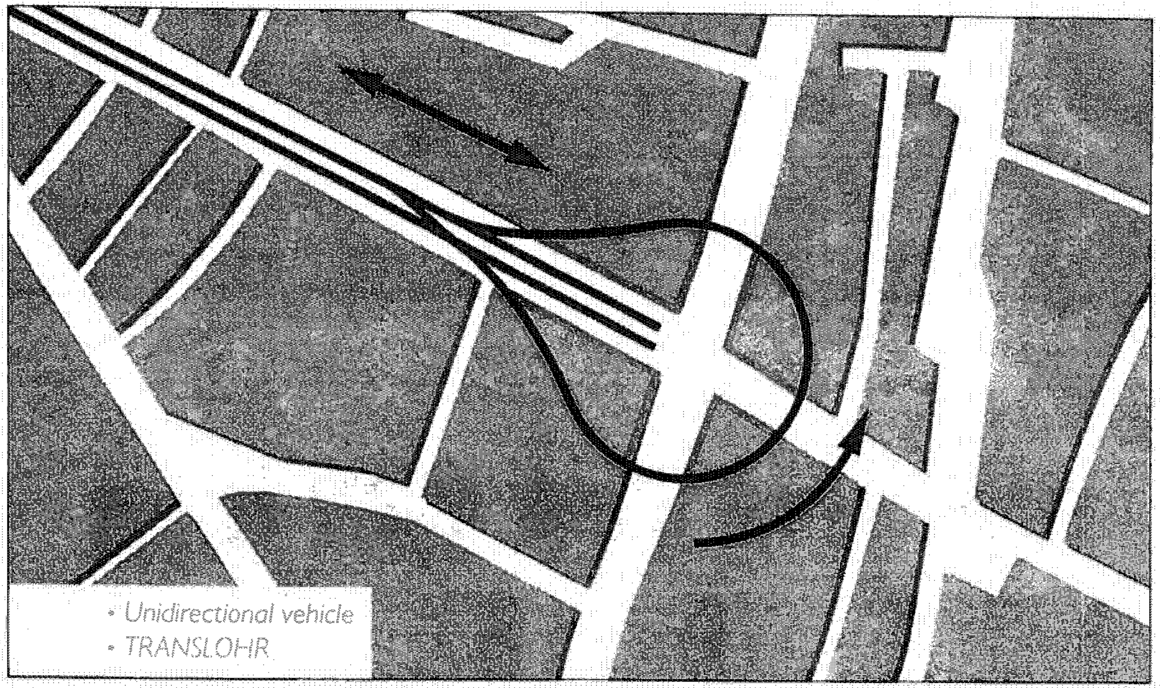
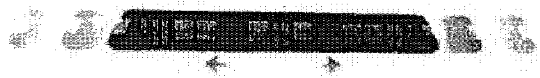




2 driving cabs, no reversal loop at both ends of the line

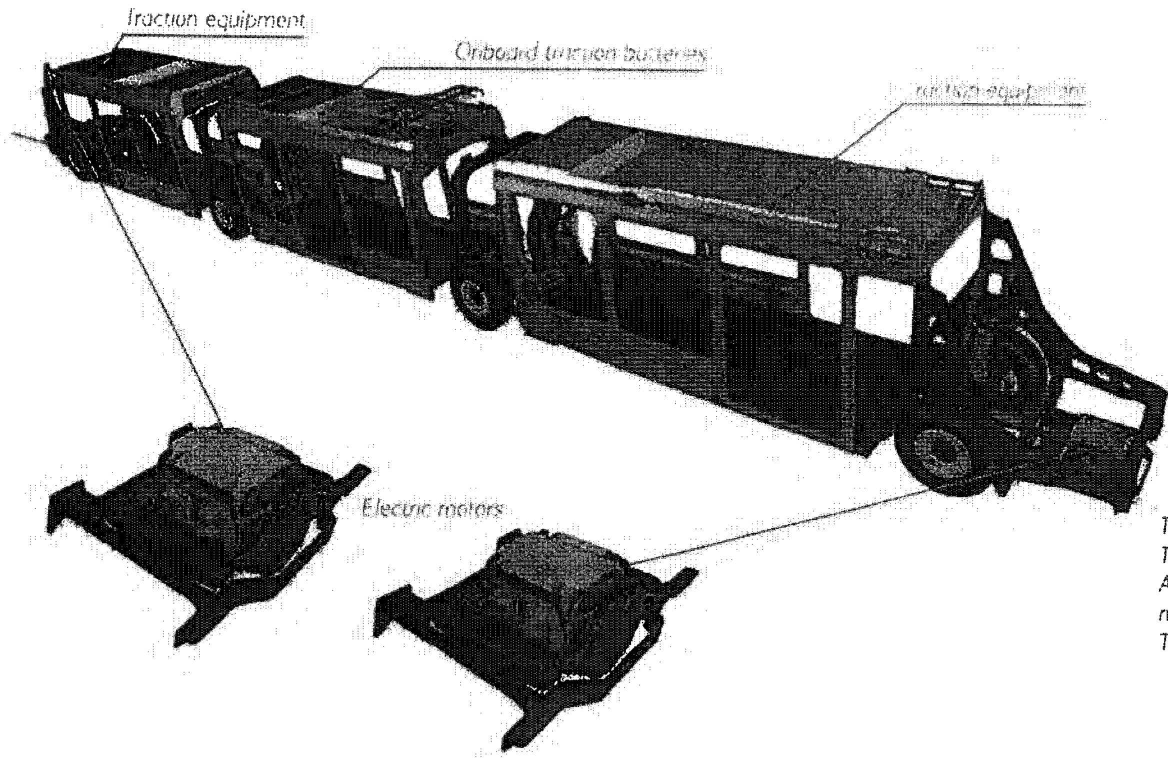
With a driving cab at each end, Translohr is bidirectional. The reversibility enables to continue the operation of the system under downgraded mode in case of incident on the line

A full tramway

Reversibility

TRANSLOHR tramway on tires

AR00085618



Translohr is equipped with:

- 2 electric motors
- 2 traction equipments to ensure the redundancy
- In option, onboard traction battery pack

The 2 electric motors are located under the 2 driving cabs
The 2 traction chains are located on the roof.
According to required performance, additional intermediate modules can be powered.
The optional battery pack is also located on the roof.

A full tramway
Electric energy

TRANSLOHR
tramway on tires

AR00085619

AR00085620

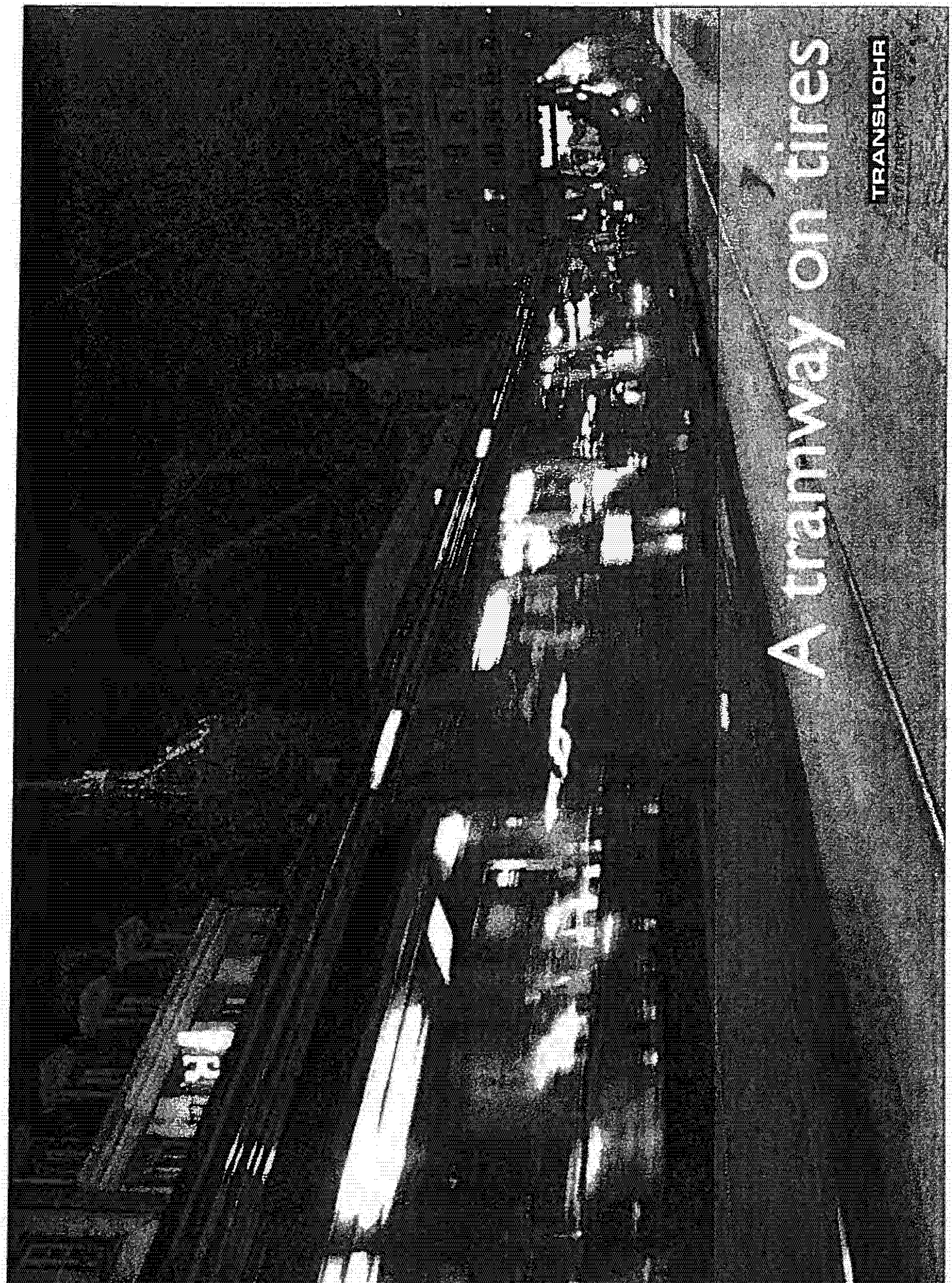
Upon specific requirements, Translohr can be equipped with onboard traction battery pack, which, on a certain distance, allows to operate without OHL

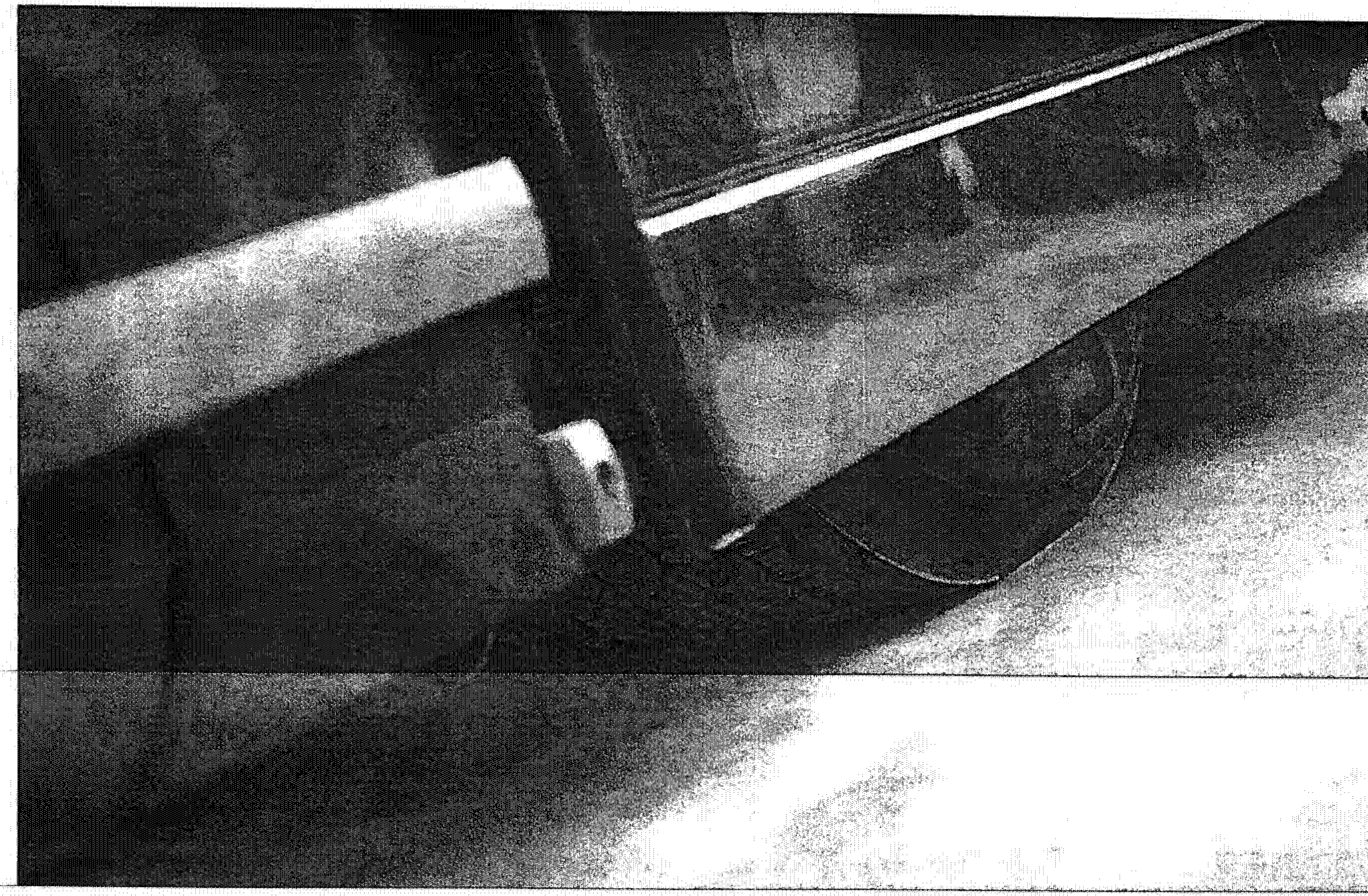
- [illegible]
- Right hand side photo, [illegible] (China): removal of [illegible] to ensure travel under bridges and in tunnels.

A full tramway

Autonomy

TRANSLOHR
tramway on tires


A tramway on tires
TRANSLOHR



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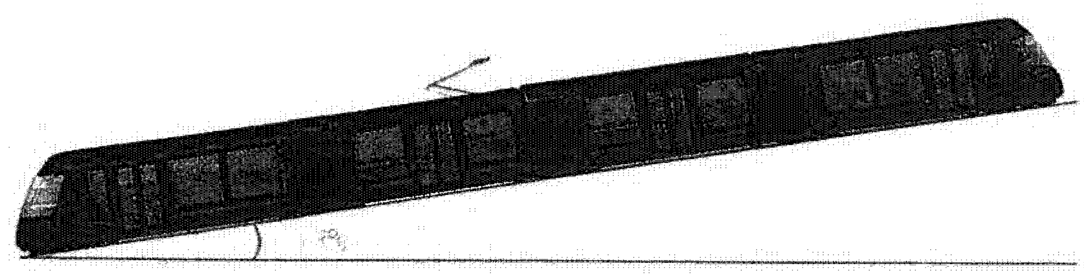


- ***Thanks to its motorization and tire adhesion, Translohr can climb slopes up to 13%***

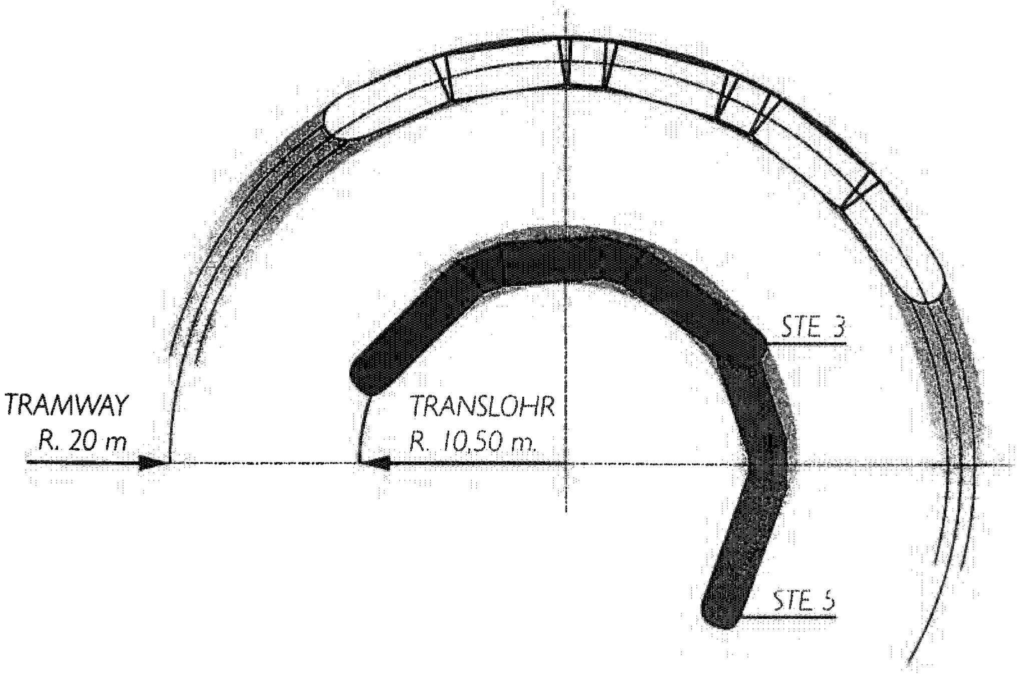
Its breaking system is highly efficient, and equipped with the most recent technologies used in road transport industry (ABS for example)

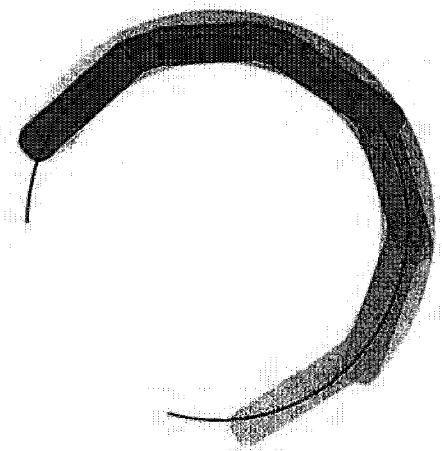
A tramway on tires

Gradient performance

TRANSLOHR
tramway on tires

AR00085624





Minimum turning radius of 10.5 meters at the rail, on the line or at the depot

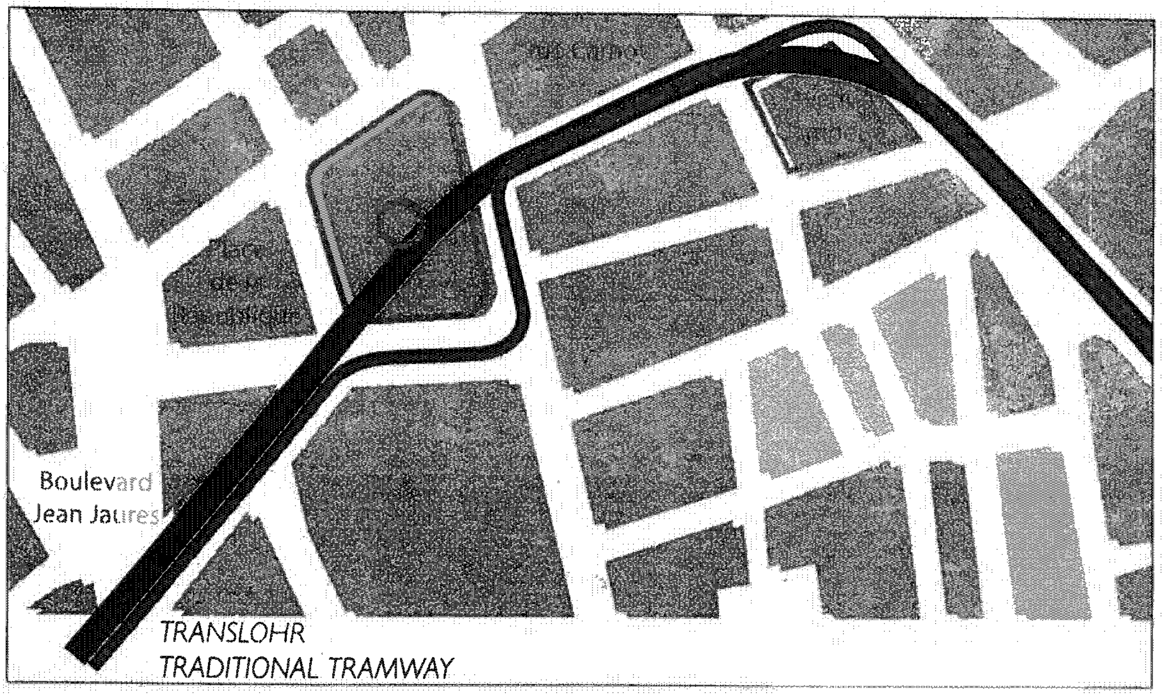
Translohr has the same turning radius, whatever the chosen model (from STE3 to STE6).

A tramway on tires

Urban insertion ability

TRANSLOHR
tramway on tires

AR00085625



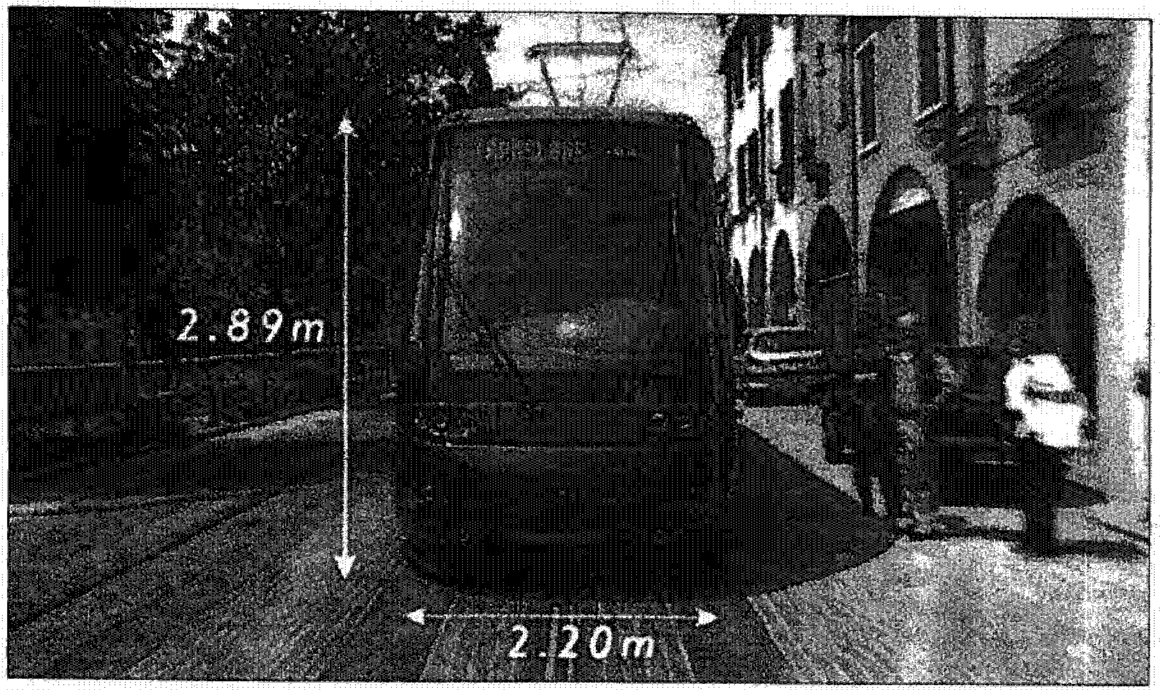
- ***With its short turning radius (10.5 m at the rail), and its small dimensions, Translohr is easily integrated in narrow streets and tight city centres.***

Translohr blends with the city, minimizes land acquisition and reduces the size of the depot

A tramway on tires

Urban insertion : suited to the city

TRANSLOHR tramway on tires



Human scale

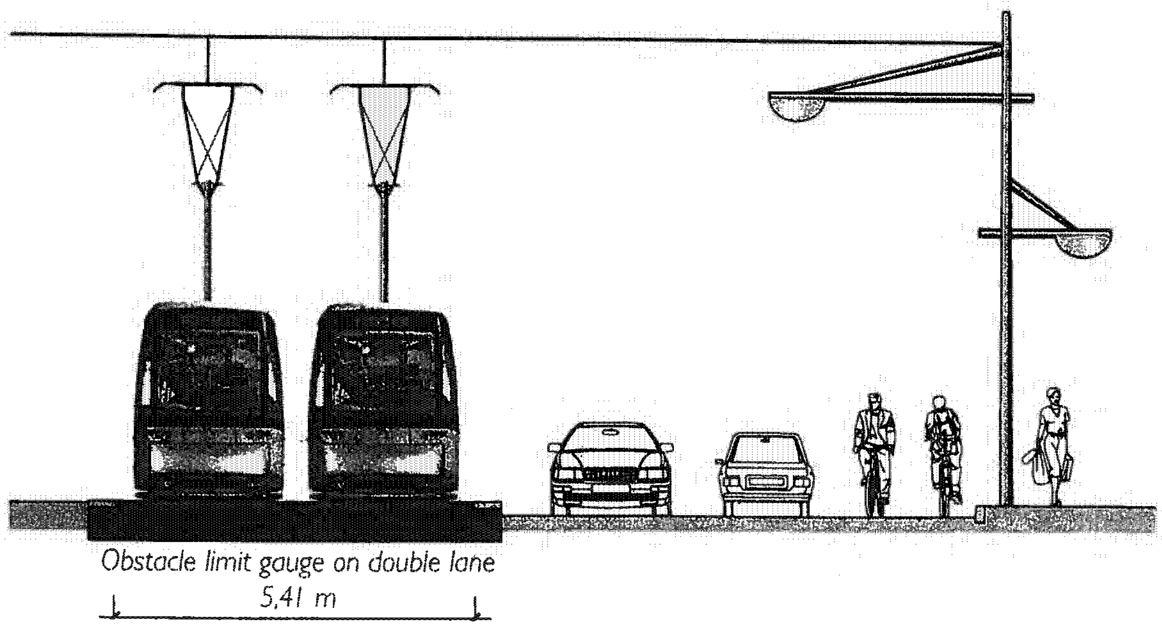
Translohr offers a unique urban insertion performance through its human-sized dimensions: width 2.20 meter, height 2.89 meter.

A tramway on tires

Human scale

TRANSLOHR
tramway on tires

AR00085627



With reduced gauge, Translohr optimizes the street surface and leaves more space for other transport modes (Pedestrian. Cars. Bicycles)

A tramway on tires

Small ground occupancy

TRANSLOHR tramway on tires

	In a straight line and in curves
At 0 km/h	71 db (A)
At 40 km/h	78 db (A)

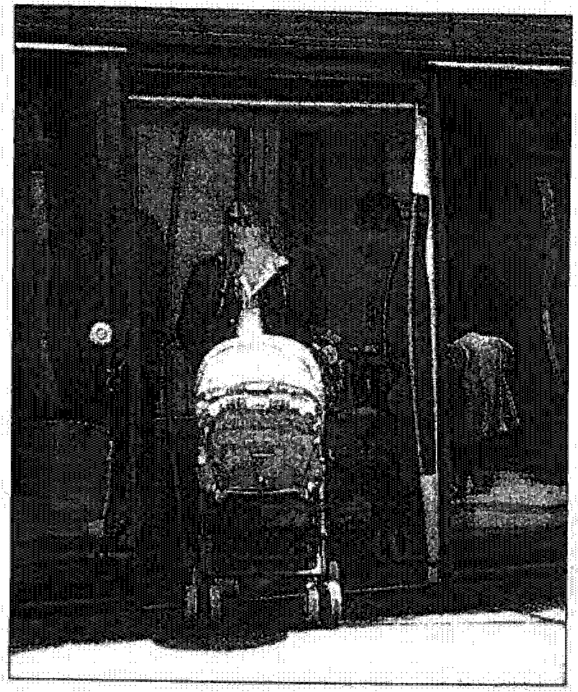
- **_No steel / steel contact (guiding rollers are covered by a rubber band)_**
- **_No crunching / no grinding (especially in curves)_**
- **_No vibration transmitted to the ground thanks to the tires and the rail sealing resin_**

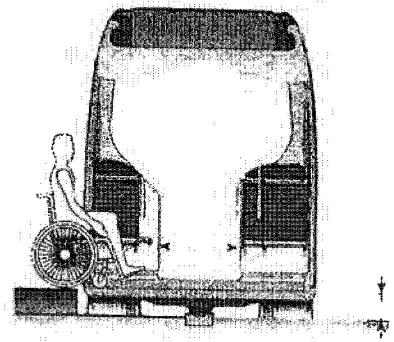
Measurements under ISO 3095

A tramway on tires
Silence

TRANSLOHR tramway on tires

AR00085629





100% low floor

A tramway on tires

Accessibility

TRANSLOHR
tramway on tires

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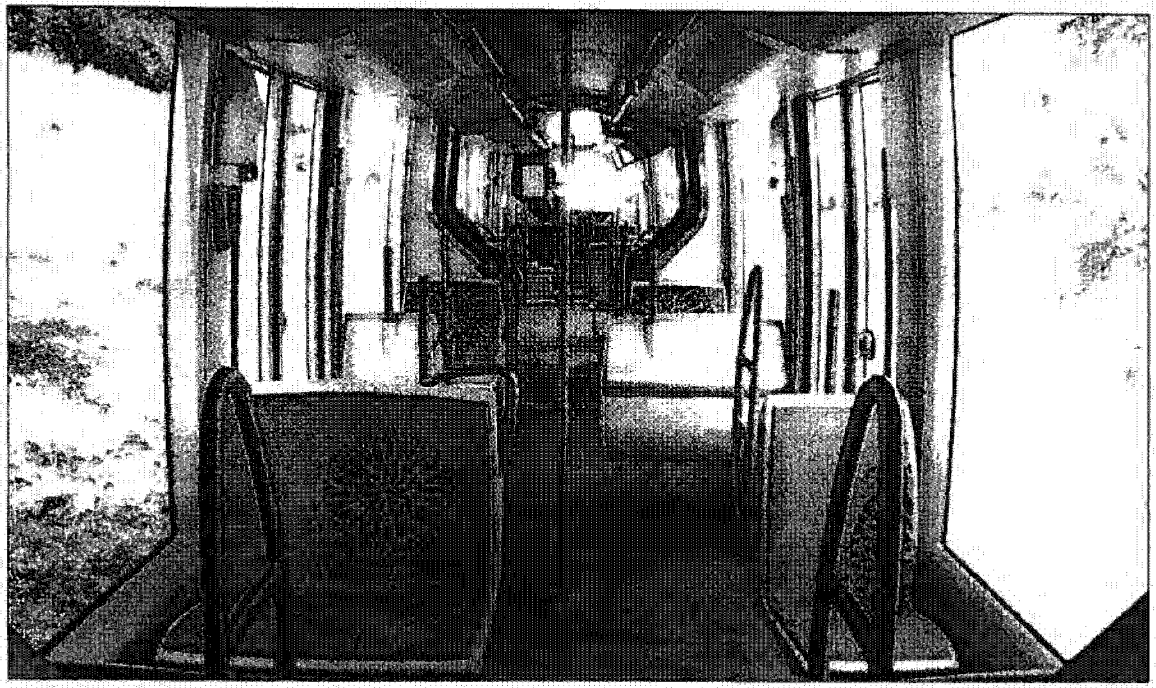
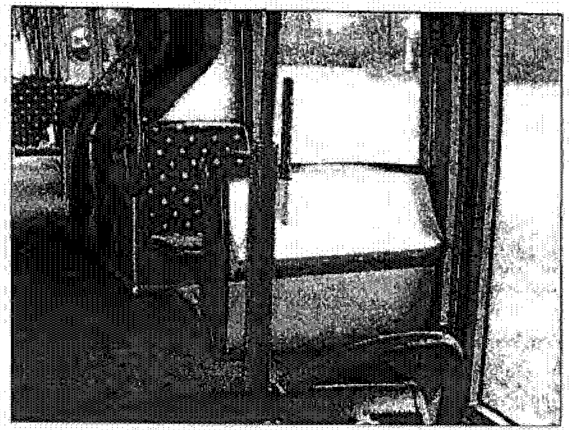




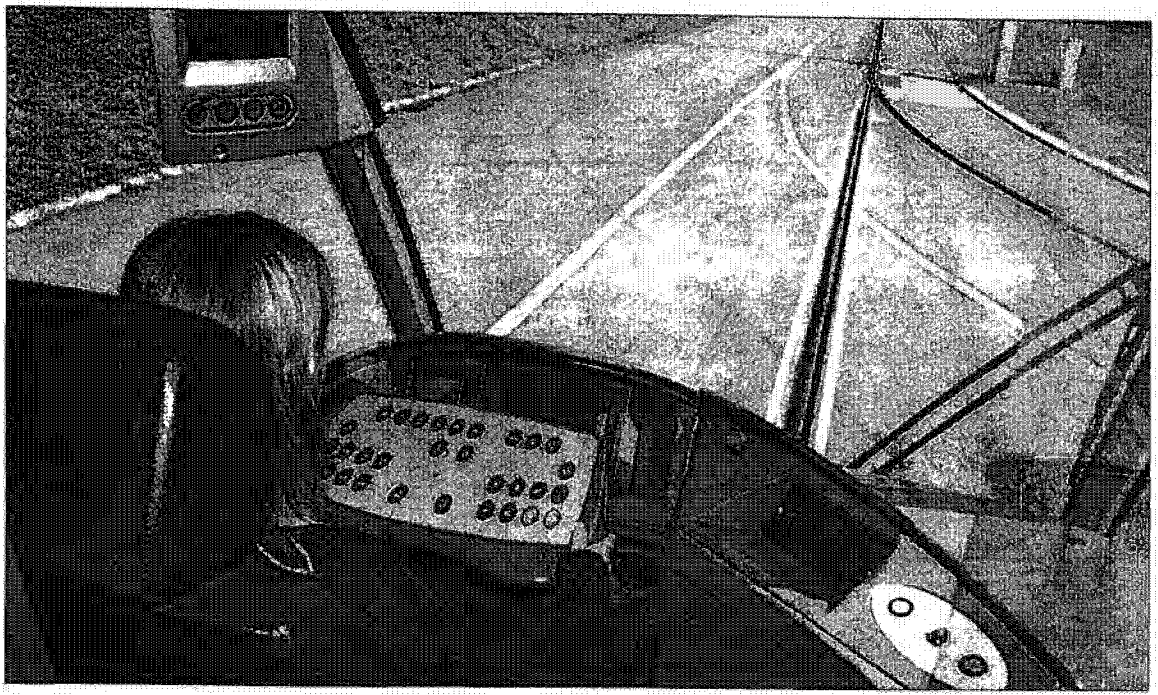
Transparency and total intercommunication

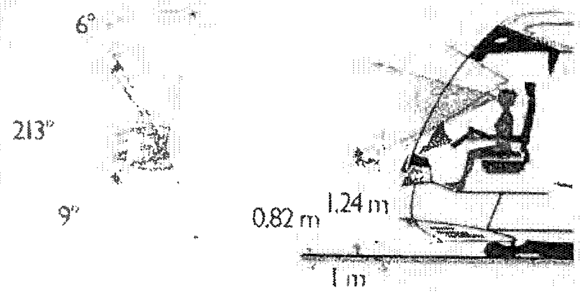
Translohr is inside fully open from cabin to cabin, through its large corridor.
Transparency is ensured through its large glasses, covering more than 70% of the whole surface.

A tramway on tires
Transparency

TRANSLOHR tramway on tires

AR00085631





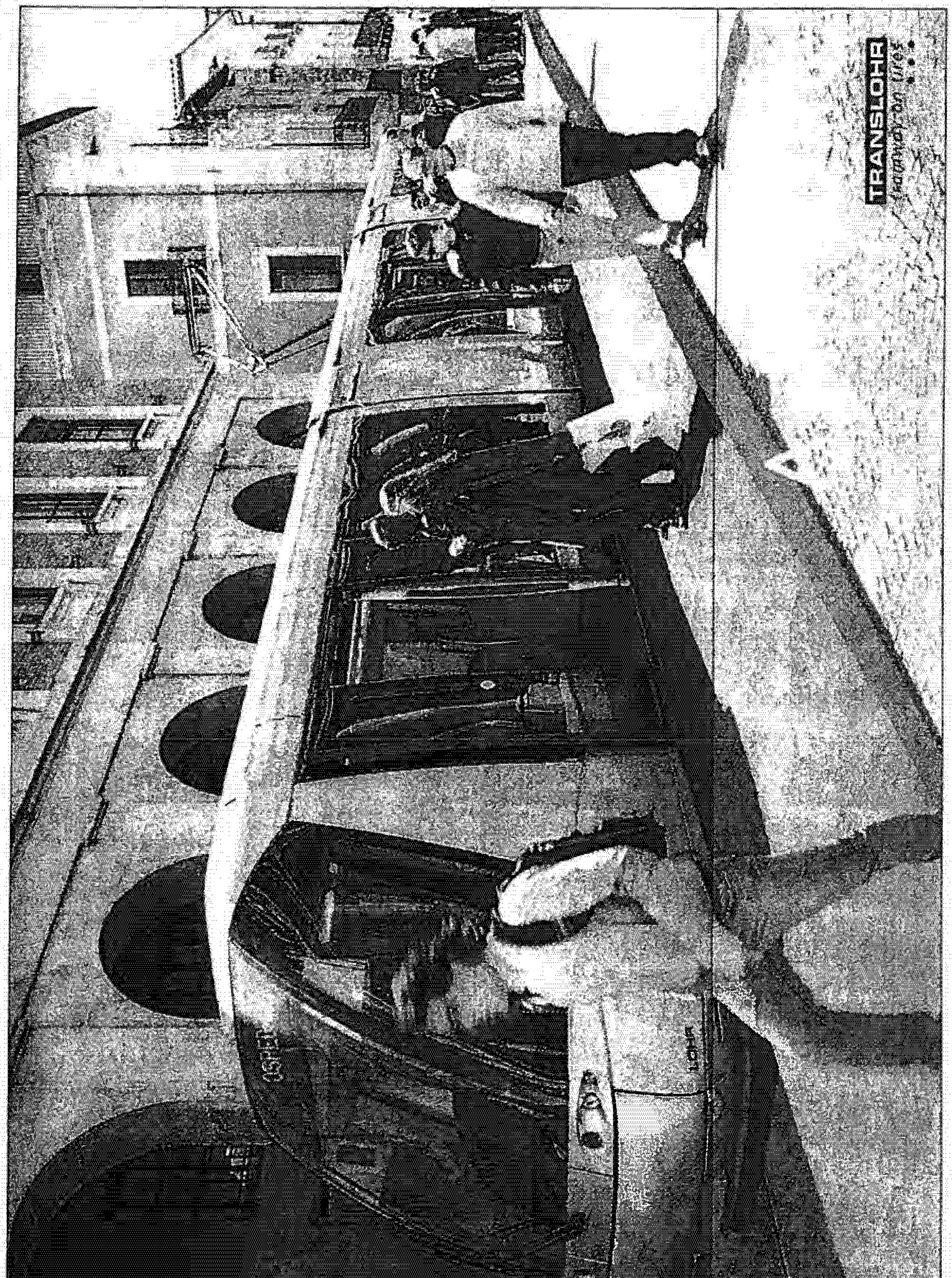
Ergonomic driving, panoramic vision

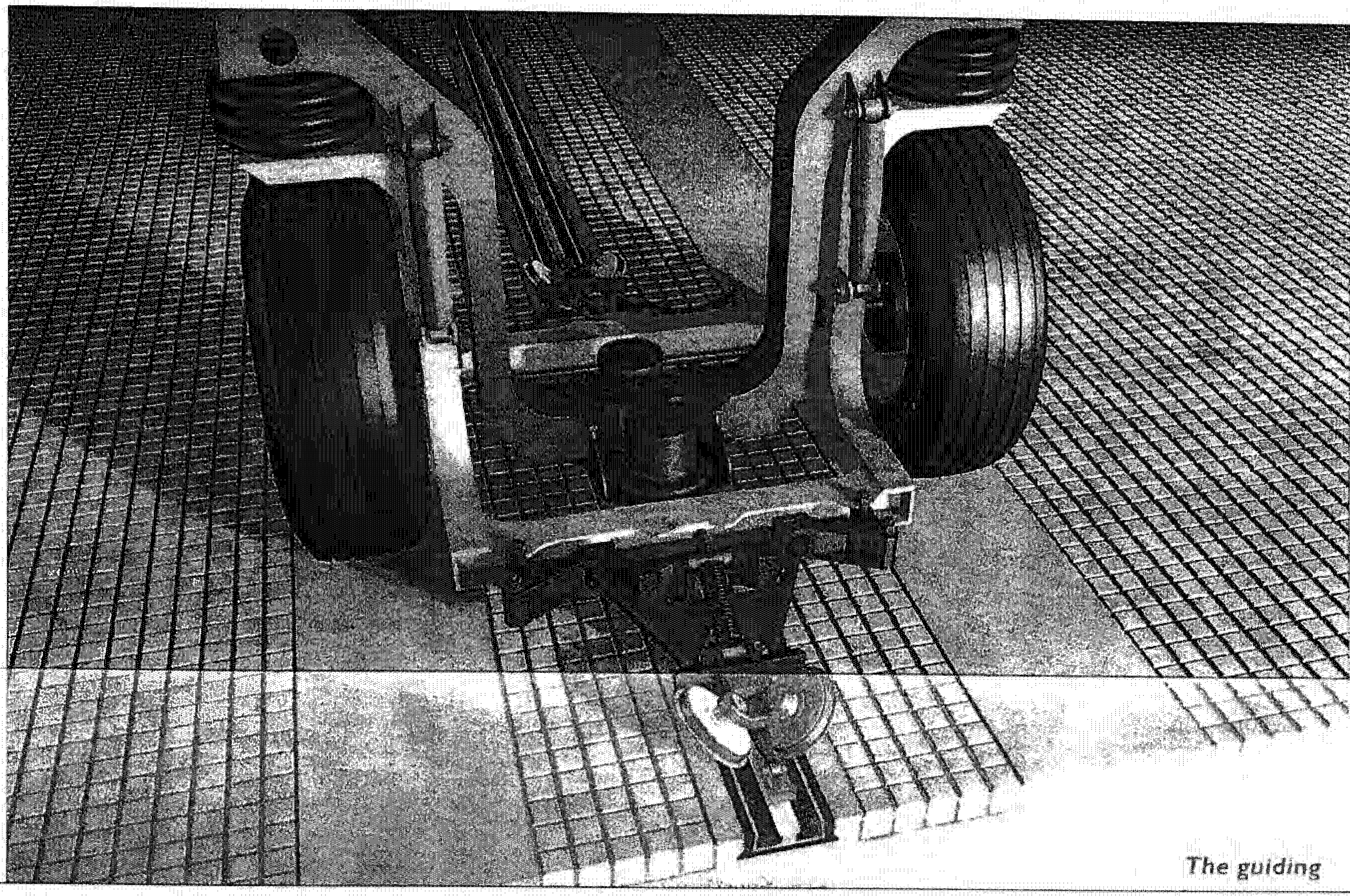
Key element of the safety [illegible] urban environment, the driving cab has been the focus of a particular attention.
Its ergonomics [illegible] the hierarchy of controls on the [illegible] have been the results of [illegible] collaboration between the Engineering and Design [illegible] validated by the experience of [illegible]
[illegible] slightly elevated, the driving cab provide the driver with [illegible] living space and driving comfort.

A tramway on tires
Driving cab

TRANSLOHR
tramway on tires

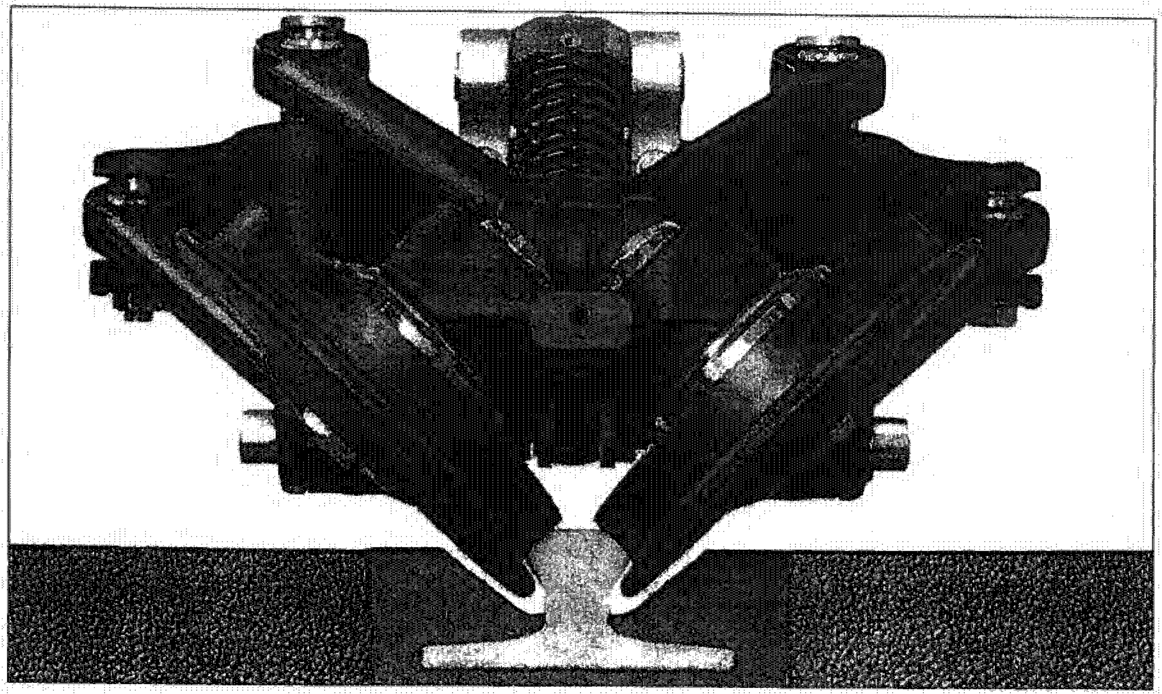
AR00085632


TRANSLOHR
Tramway on tyres



The guiding

AR00085634



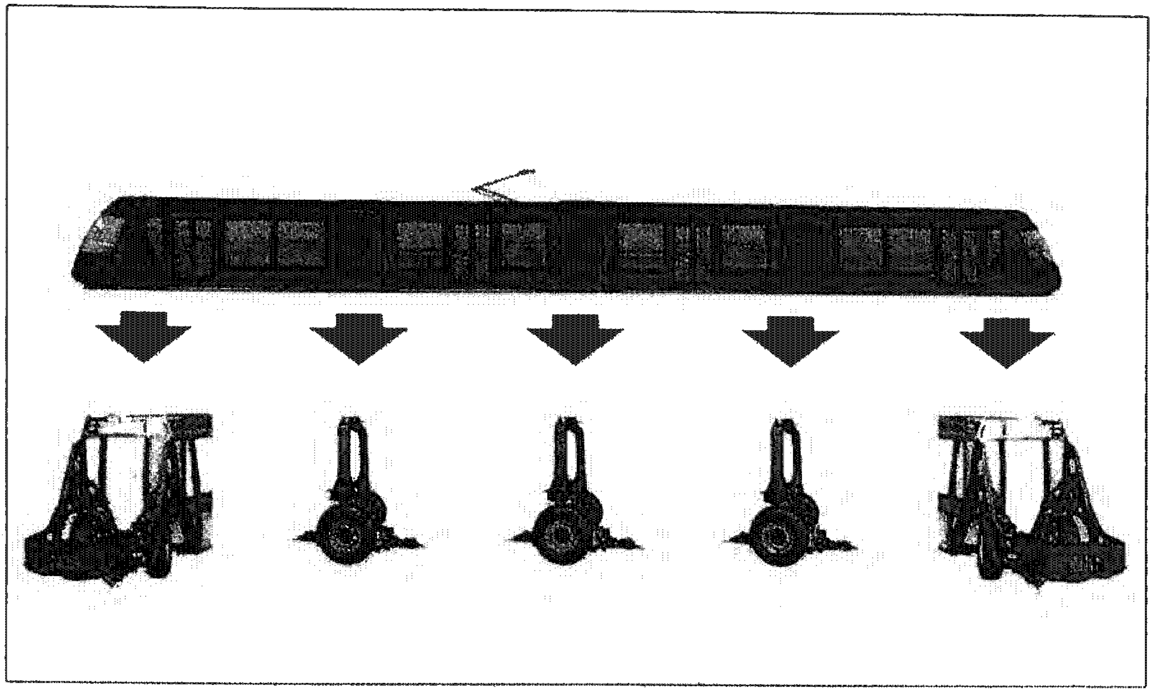
Translohr guiding is ensured by 2 V rollers fixed on each axle, tilted at 45° each, mechanically locked on the central rail

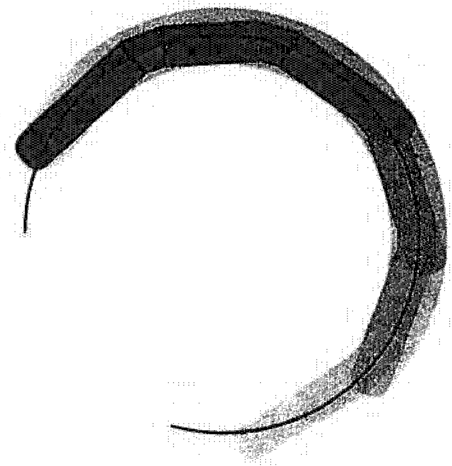
The internal sides of the rollers are covered by a rubber band, avoiding then steel / steel contact and ensuring the running silence.
A vertical load of 150 kg ensures their contact with the rail.
The overall vertical and lateral forces are only borne by the tires not by the guiding device

A safe guiding

The «V» guiding system

TRANSLOHR tramway on tires



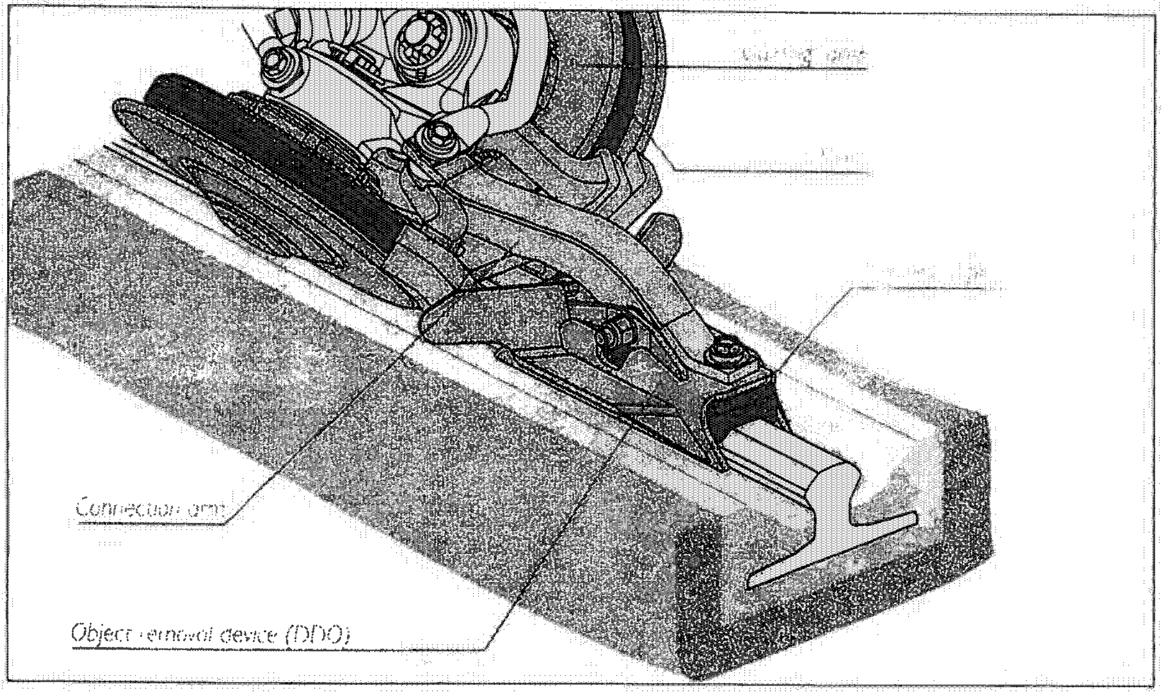


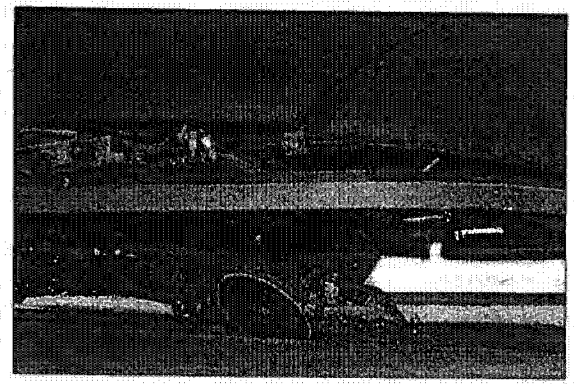
All the axles are guided. This guarantees the precision of the trajectory, the perfect docking at stations, without any effort nor wear on the rail.

A safe guiding

Integral and permanent guiding

TRANSLOHR
tramway on tires





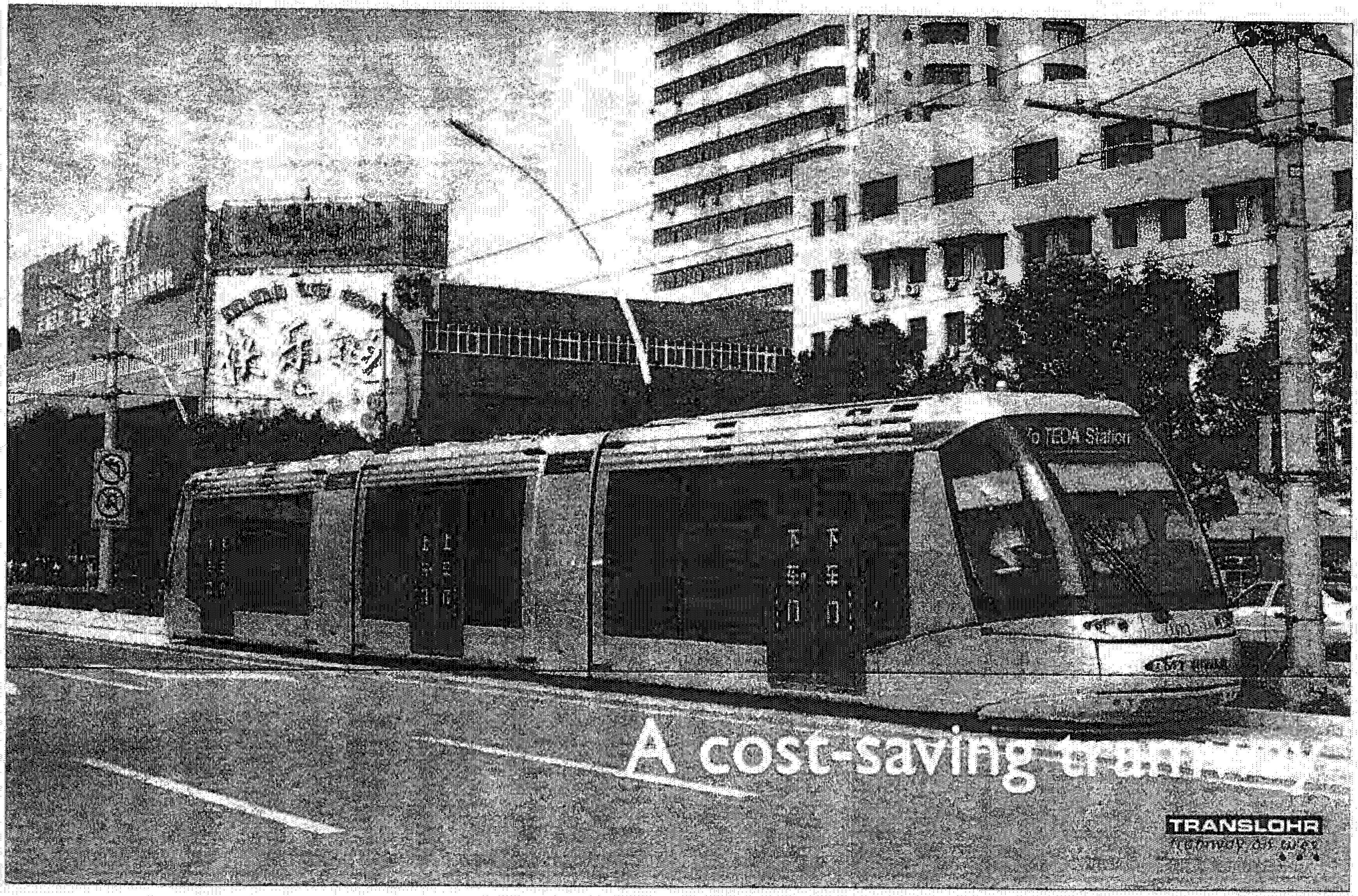
Safety enhanced by an object removal specific device (DDO) installed on each guiding system

The DDO is mounted directly on the return current pad. It cleans both sides of the rail and is able to remove objects or obstacles.

A safe guiding
Optimized safety

TRANSLOHR
tramway on tires

AR00085637



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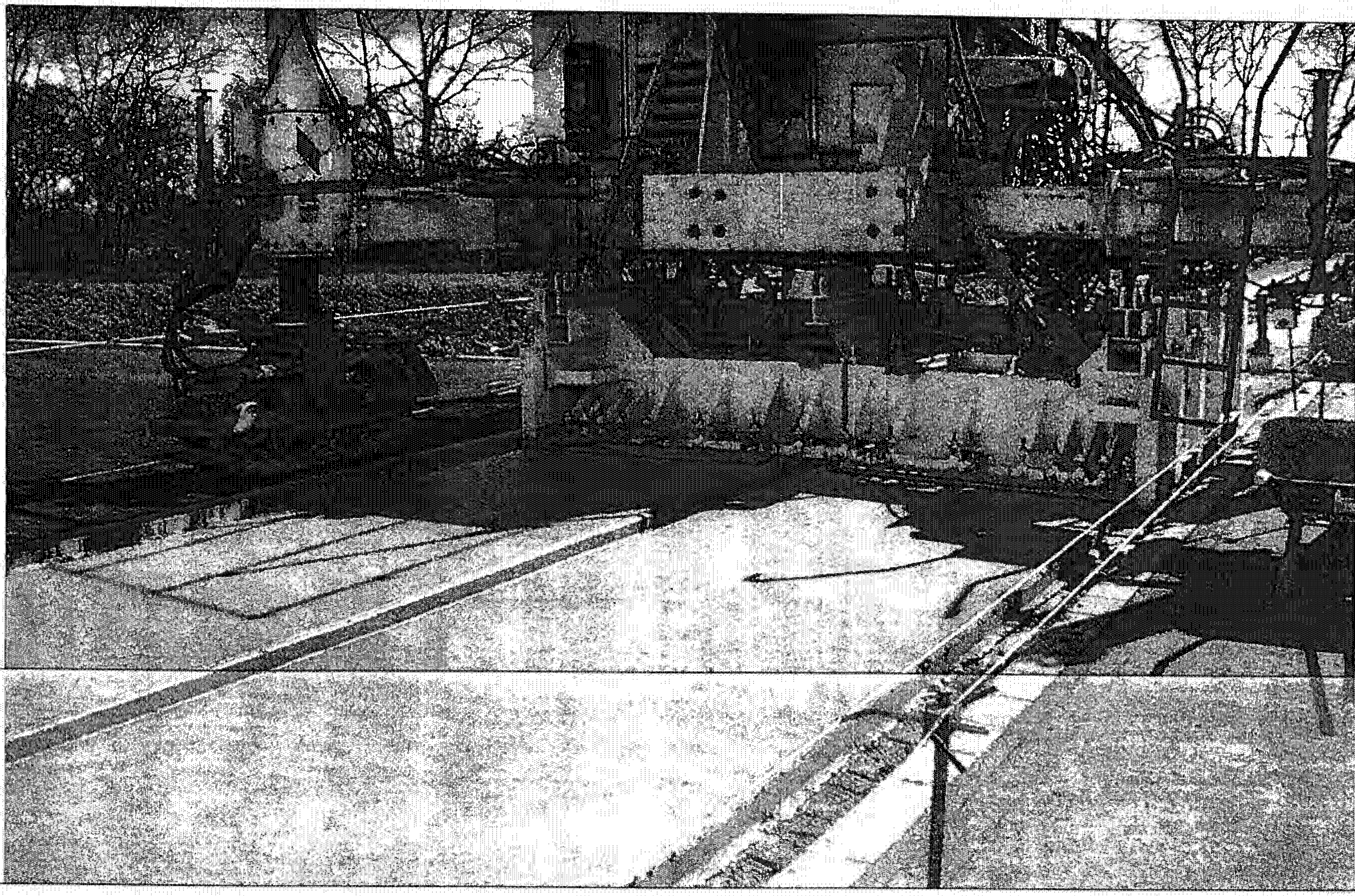
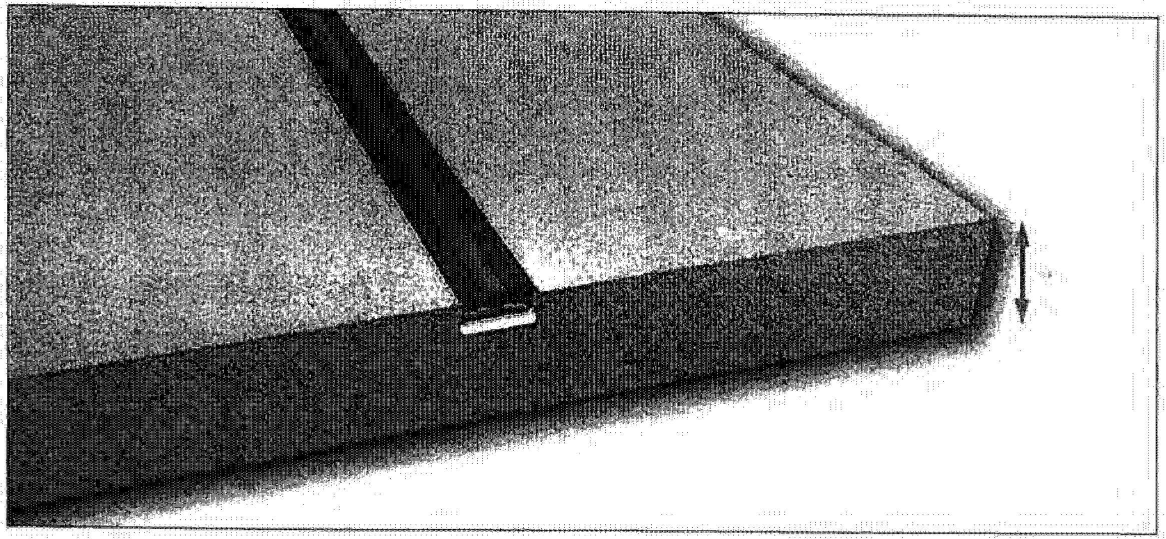
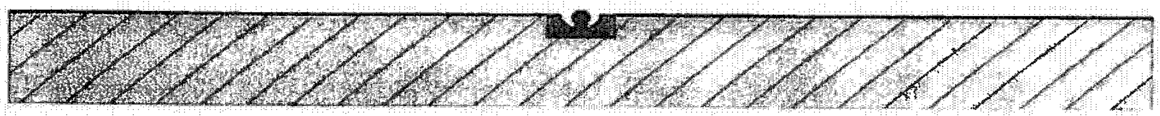






Due to its good load distribution and its low weight per axle (9 000 kg), Translohr infrastructures can be optimized

The separation of the load bearing functions (carried out by the tires) and the guiding functions (carried out by the central rail) enables an optimisation of Translohr track. Its thickness does not exceed 30cm.

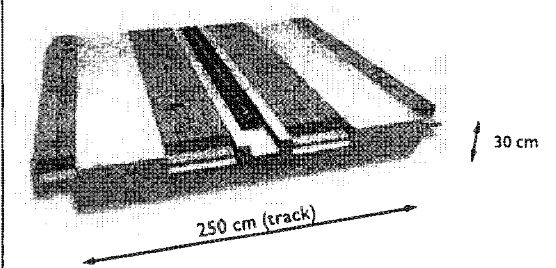
Implementation of the Translohr track requires a limited number of operations:

1. *Laying of concrete of 24 to 30 cm thickness, with a reserved space for the guiding rail ; the concrete is used both as a track base and a running surface for Translohr.*
2. *Rail laying using resin embedding.*

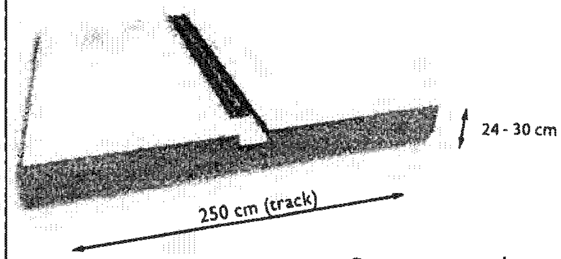
A cost-saving tramway
Infrastructures

TRANSLOHR tramway on tires

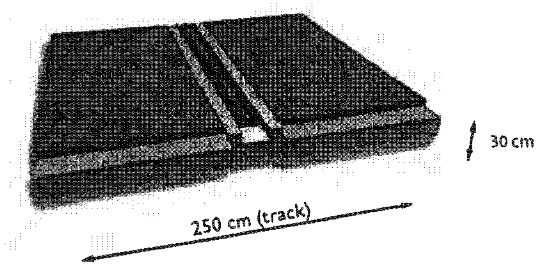
AR00085641



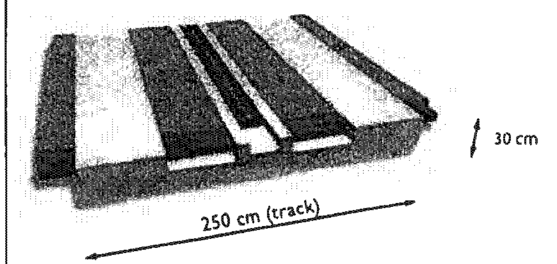
Concrete roadway with paving-stone finish



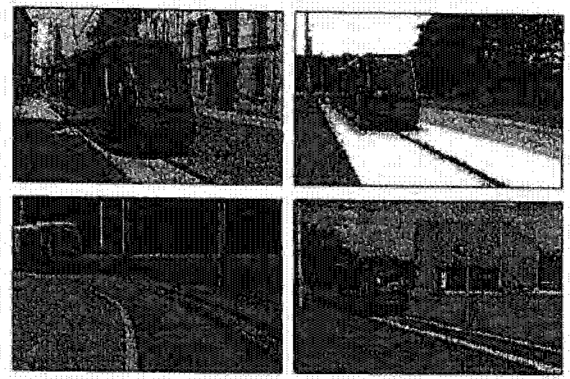
Concrete roadway



Tarmac section roadway



Concrete roadway with grass finish



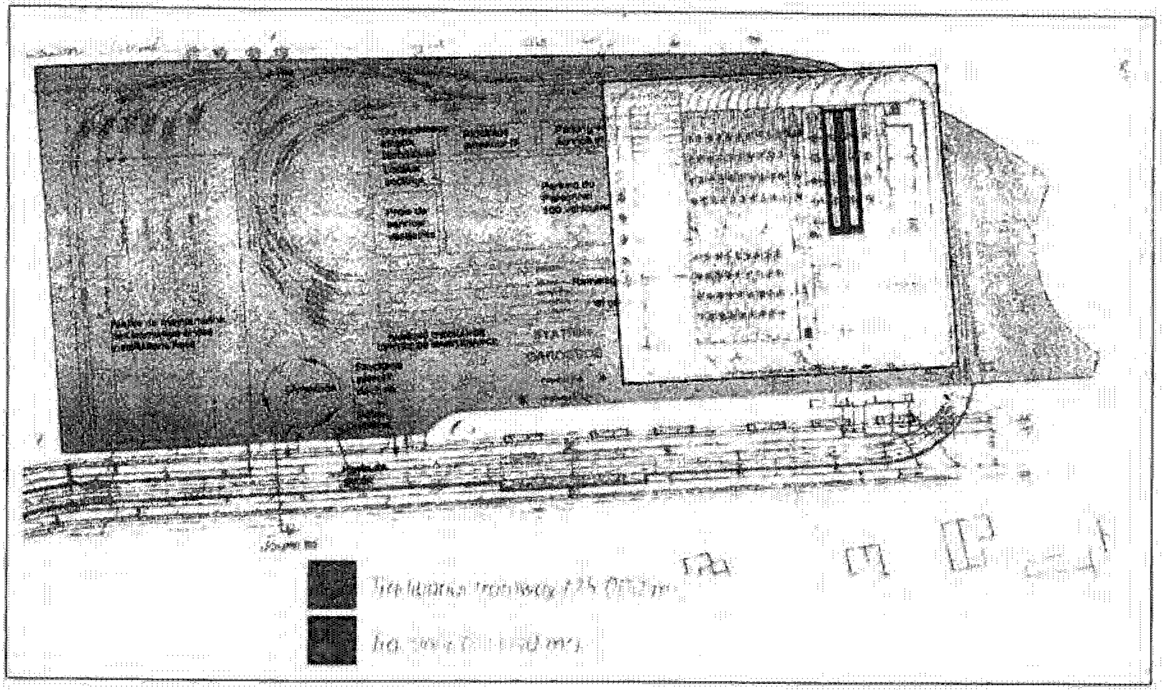
Several roadway finishes are possible

For optimized tracks any attractive solution can be proposed: finishing with paving stones, grass, granite or colour coatings.

A cost-saving tramway Track

TRANSLOHR tramway on tires

AR00085642



Example of a required depot for a fleet of 20 units

Thanks to its turning radius of 10.5 m and its narrow gauge, the Translohr depot area is at least 50% smaller than for a traditional tramway.

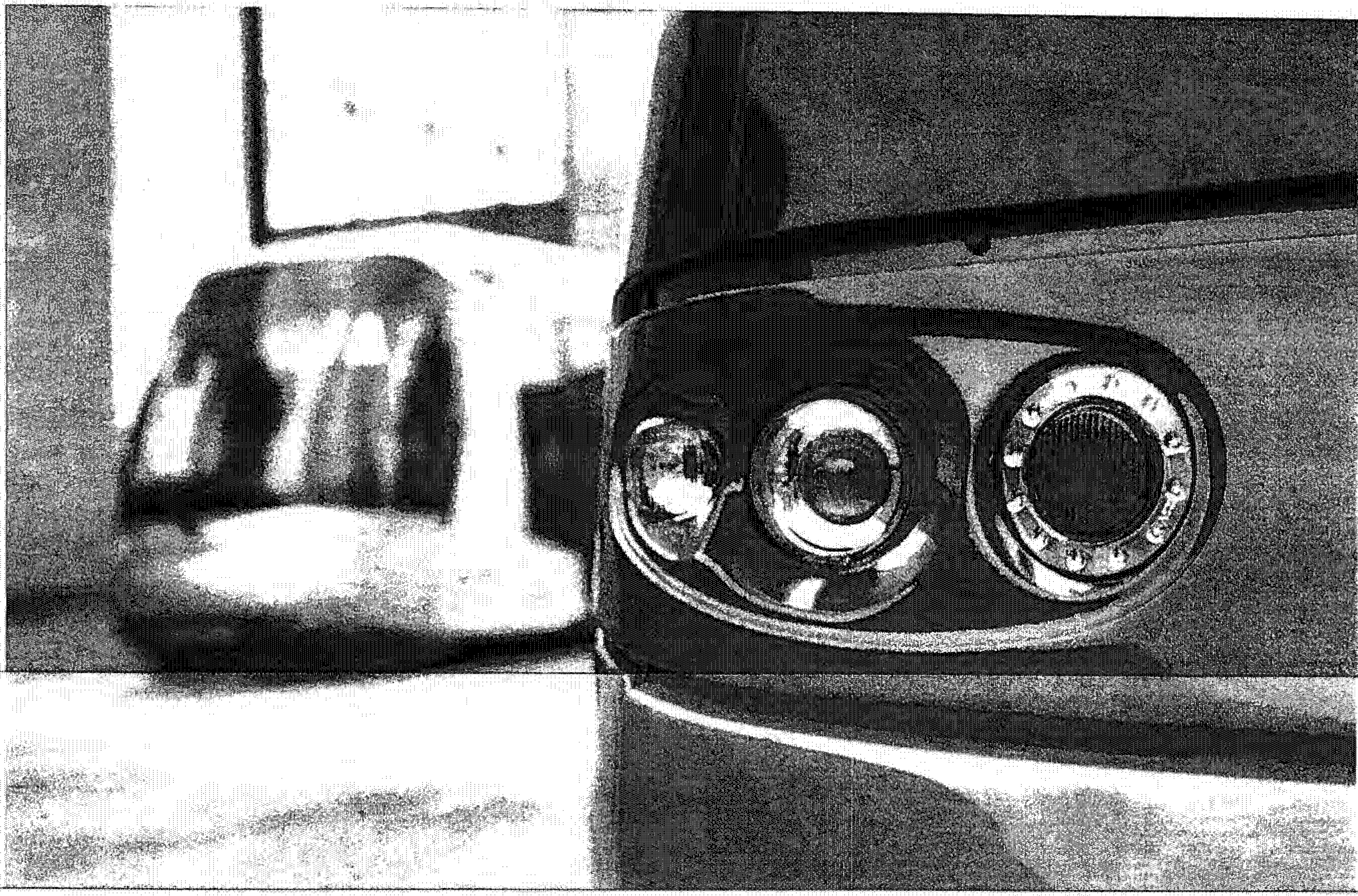
A cost-saving tramway

Optimisation of the depot ground occupancy

TRANSLOHR
tramway on tires

AR00085643


A customizable tramway
TRANSLOHR



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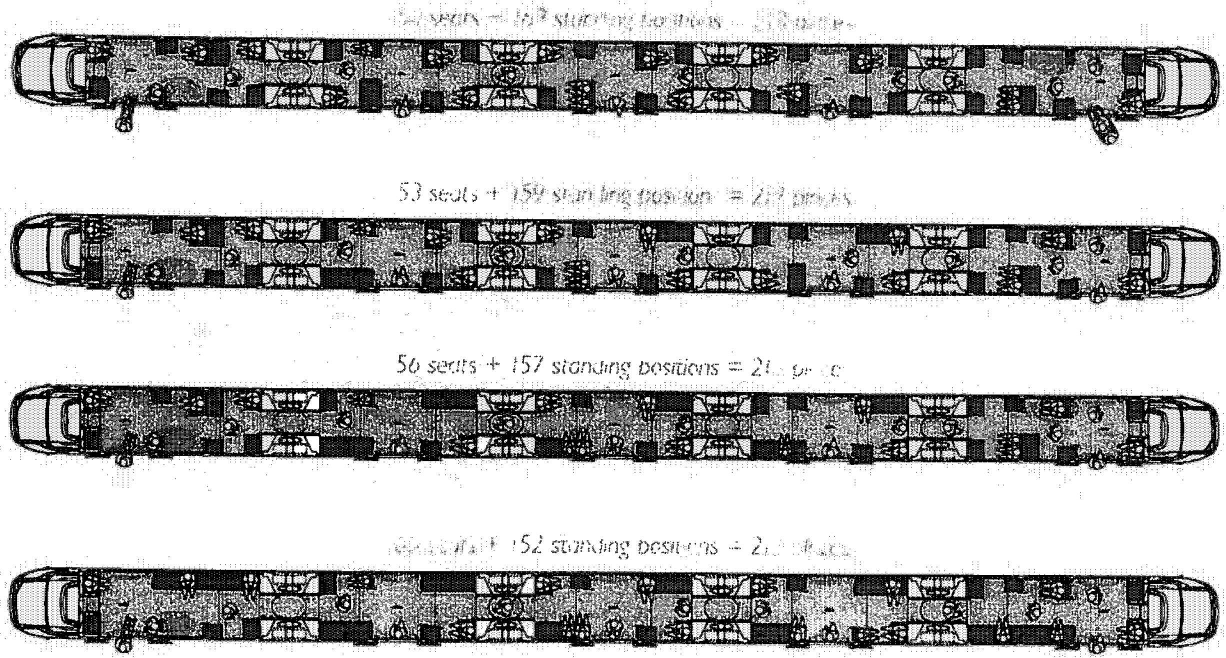
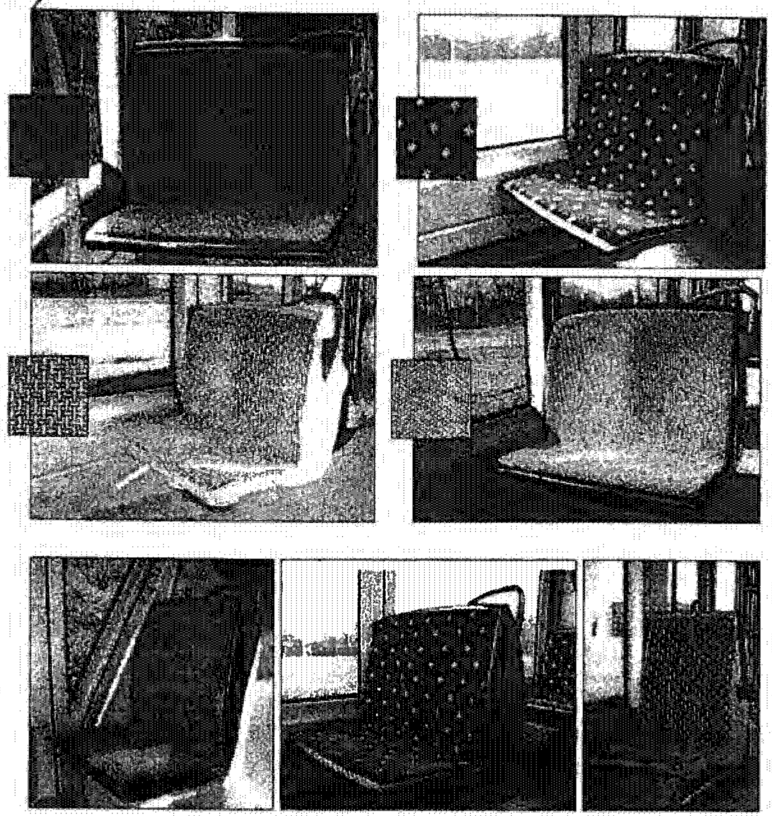


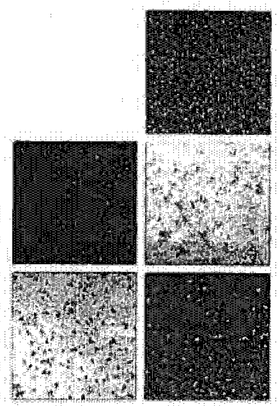
- **_Free positioning of the seats according to requirement_**
- **_Addition or removal of seats according to need evolution_**

A customizable tramway
Interior layout

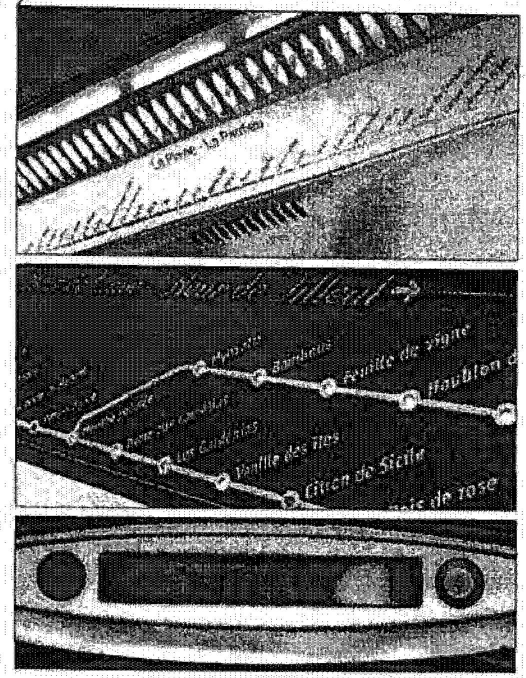
TRANSLOHR
tramway on tires

Seats

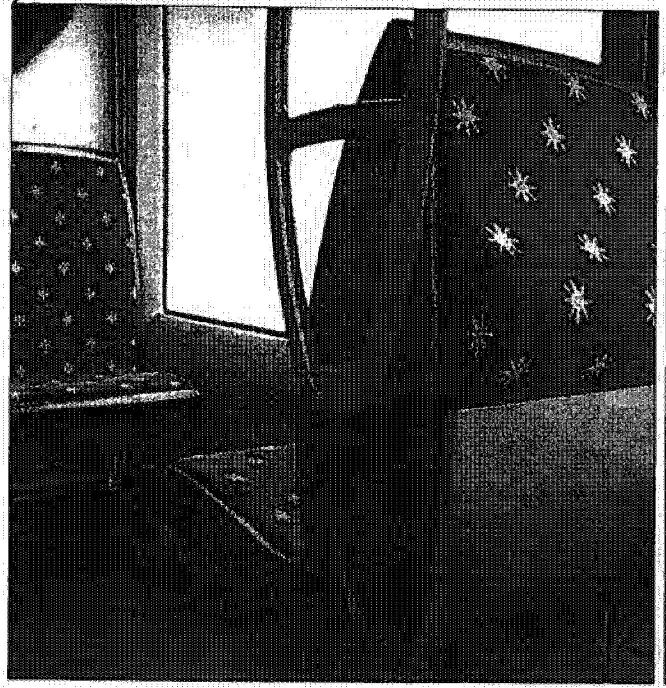


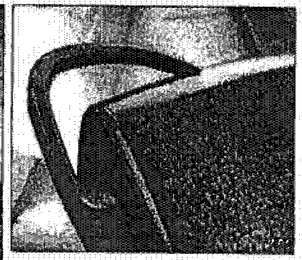


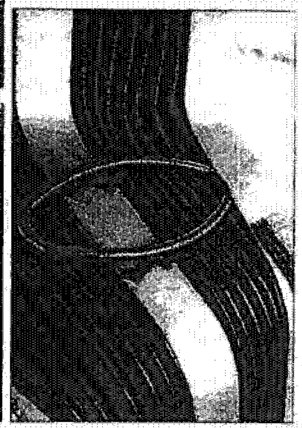
Ceiling lights



Assist bars







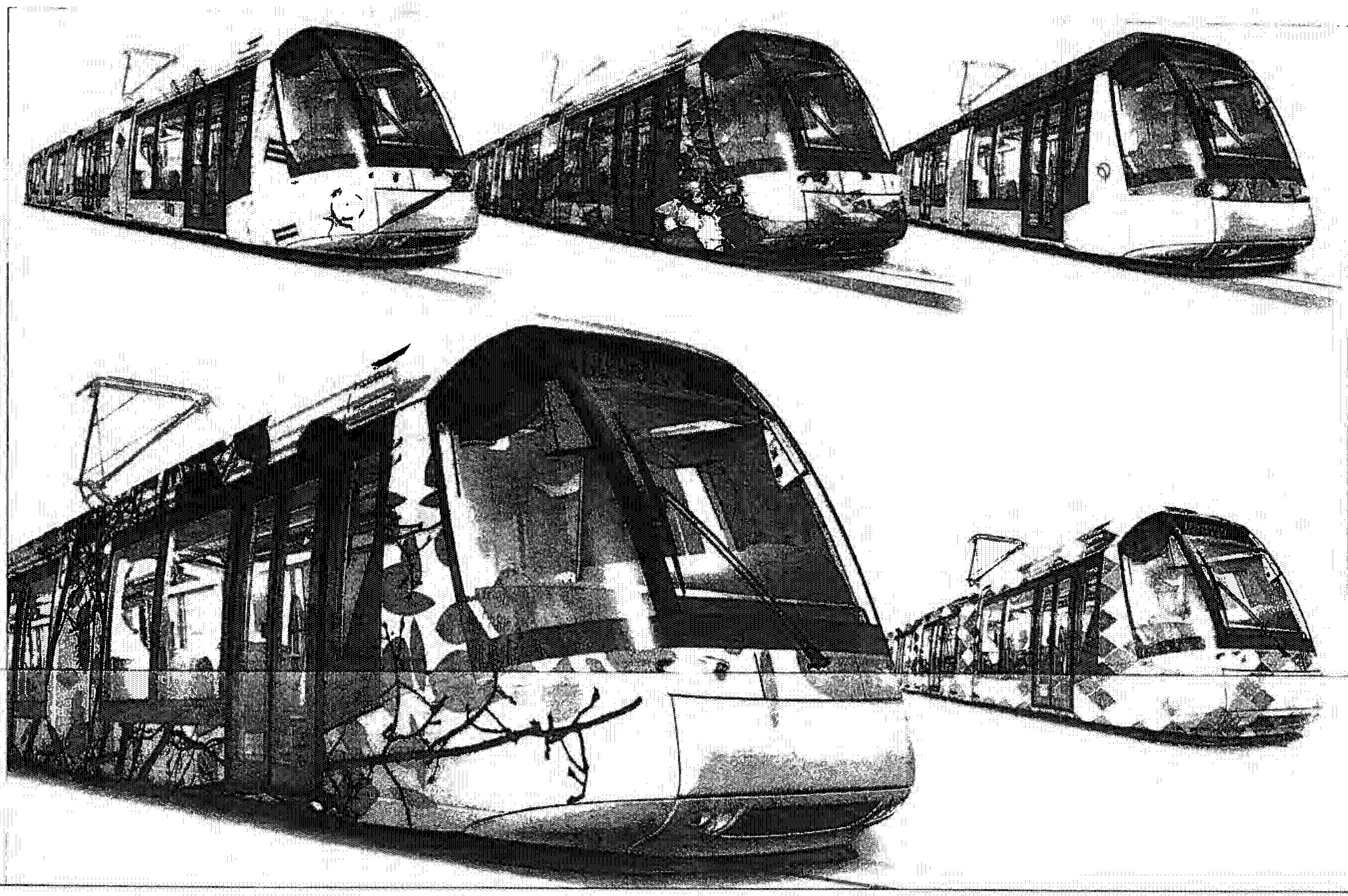
Reduced Mobility Persons area

- *Creation of internal atmospheres, customized materials and colours*

A customizable tramway

Interior layout

TRANSLOHR
tramway on tires



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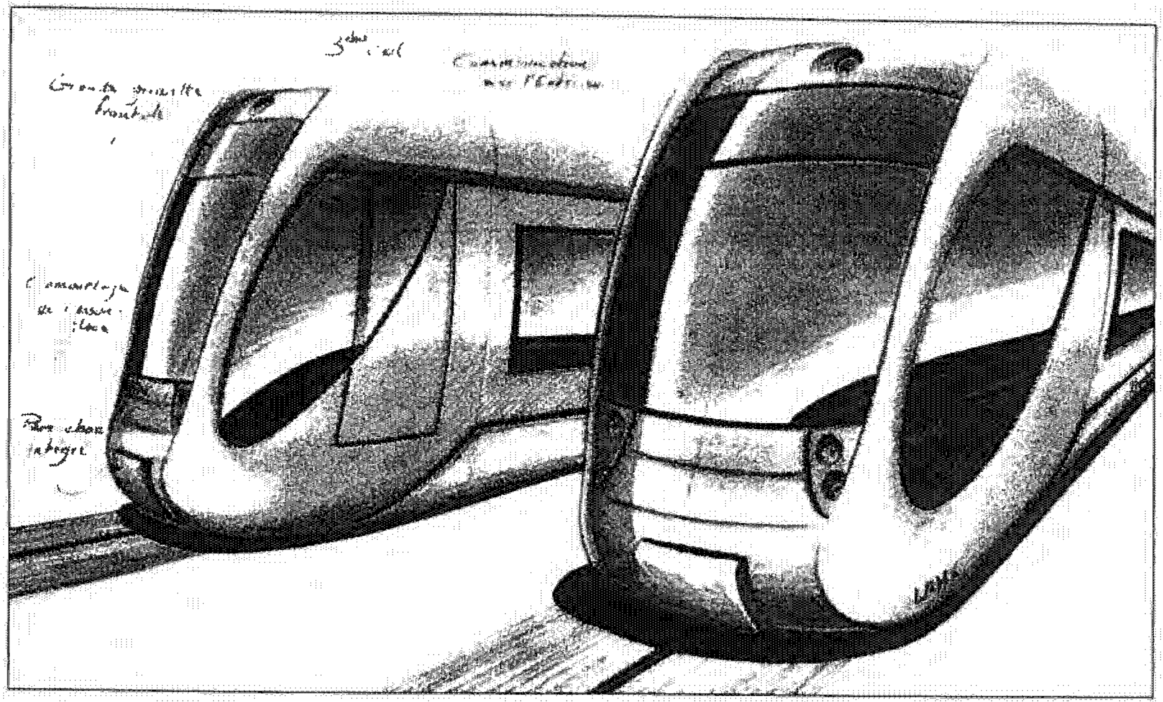

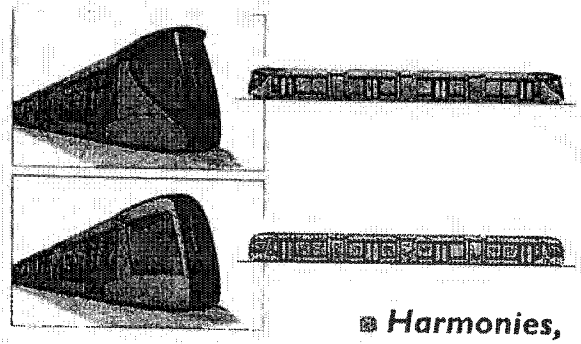

Harmonies, personalisation of ends

The Translohr design draws its inspirations from a strong determination to bring out the value of the service, and present an attractive vehicle, entirely dedicated to the citizen and in harmony with it's urban environment.
For the citizen, Translohr looking should be an incitement to use it as a convenient transport means, but travelling on Translohr could also be synonym of a travel in the heart of the city and even beyond.
Reason why we compose the set of harmonies which will label it.

A customizable tramway Liveries

TRANSLOHR
tramway on tires

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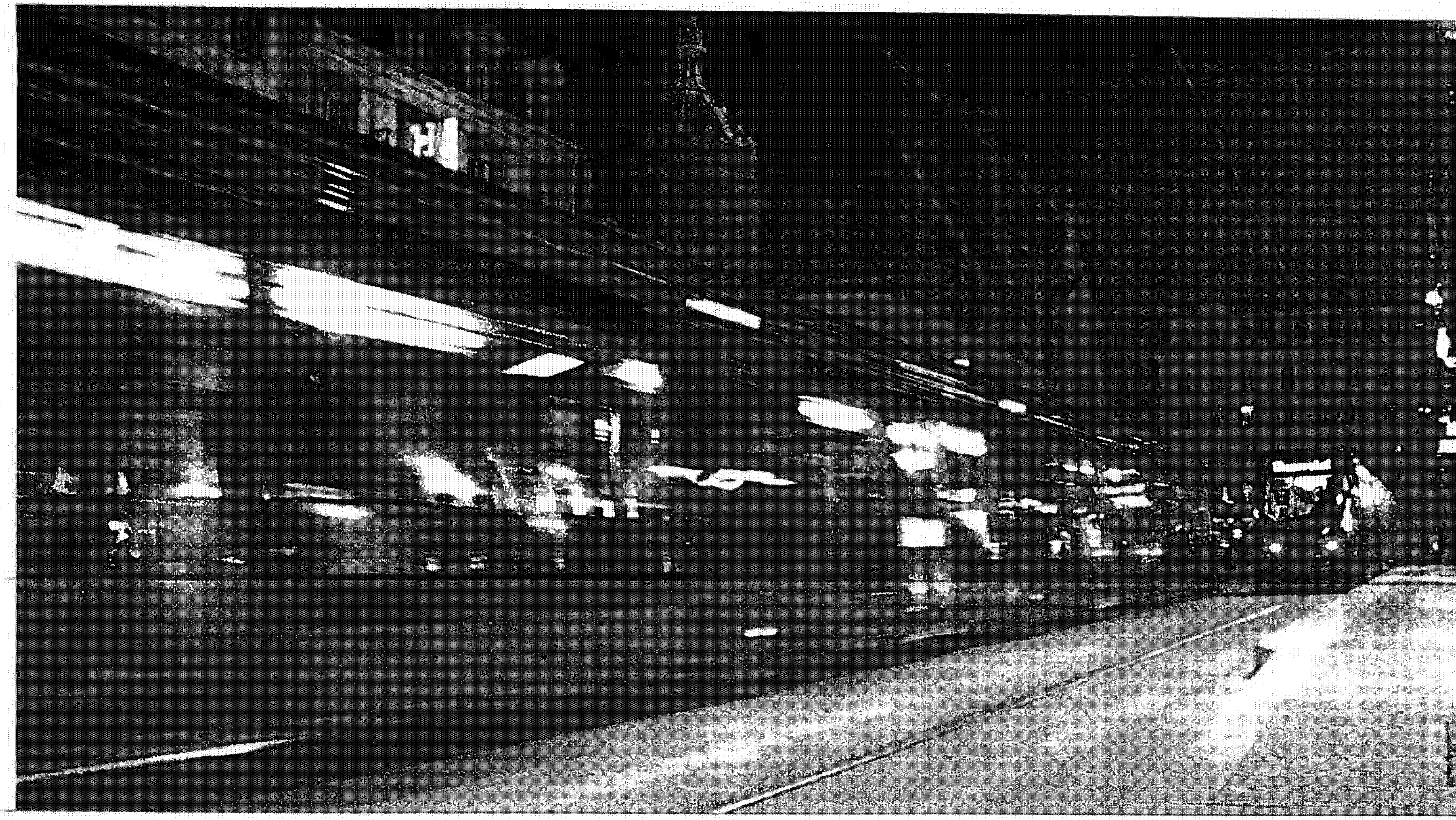
Main facilities :
Zone industrielle, F-67120 Duppigheim - France
www.lohr.fr


Translohr Cities
TRAMWAY ON TIRES
LOHR



Clermont-Ferrand | 1

AR00085654

Translohr, Tramway on tires

A mode of economical transportation which is environmentally friendly, and easy to insert in the urban landscape with a minimal ground occupancy ; in support of sustainable urban mobility. Lohr has designed and manufactures the Translohr.

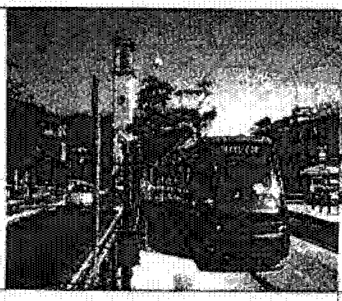
It allies all the characteristics of a modern tramway...

- fully guided (by one single central rail),
- high transport capacity (range from 25 to 46 meters),
- bidirectional (2 driving cabins),
- wide corridor throughout the entire vehicle,
- 100% low-floor (at 25 cm from the roadway),
- electrical traction

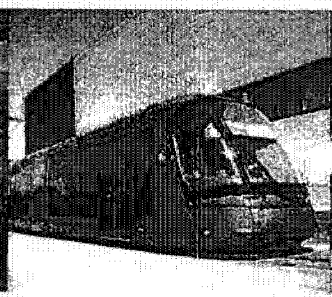
... With the advantages of the tire :

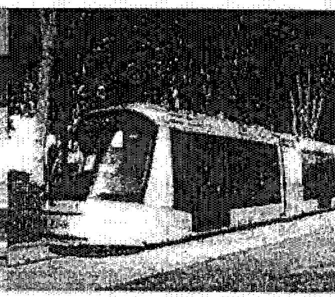
- silence (no steel / steel contact),
- short turning radius (10,5 meters at the rail),
- adhesion (13% slope performance),
- efficient braking,
- light infrastructures.

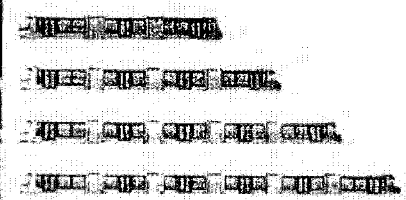
Clermont-Ferrand (France), Padua, L'Aquila, Mestre-Venice (Italy), Tianjin (China) have already chosen Translohr.


Padua

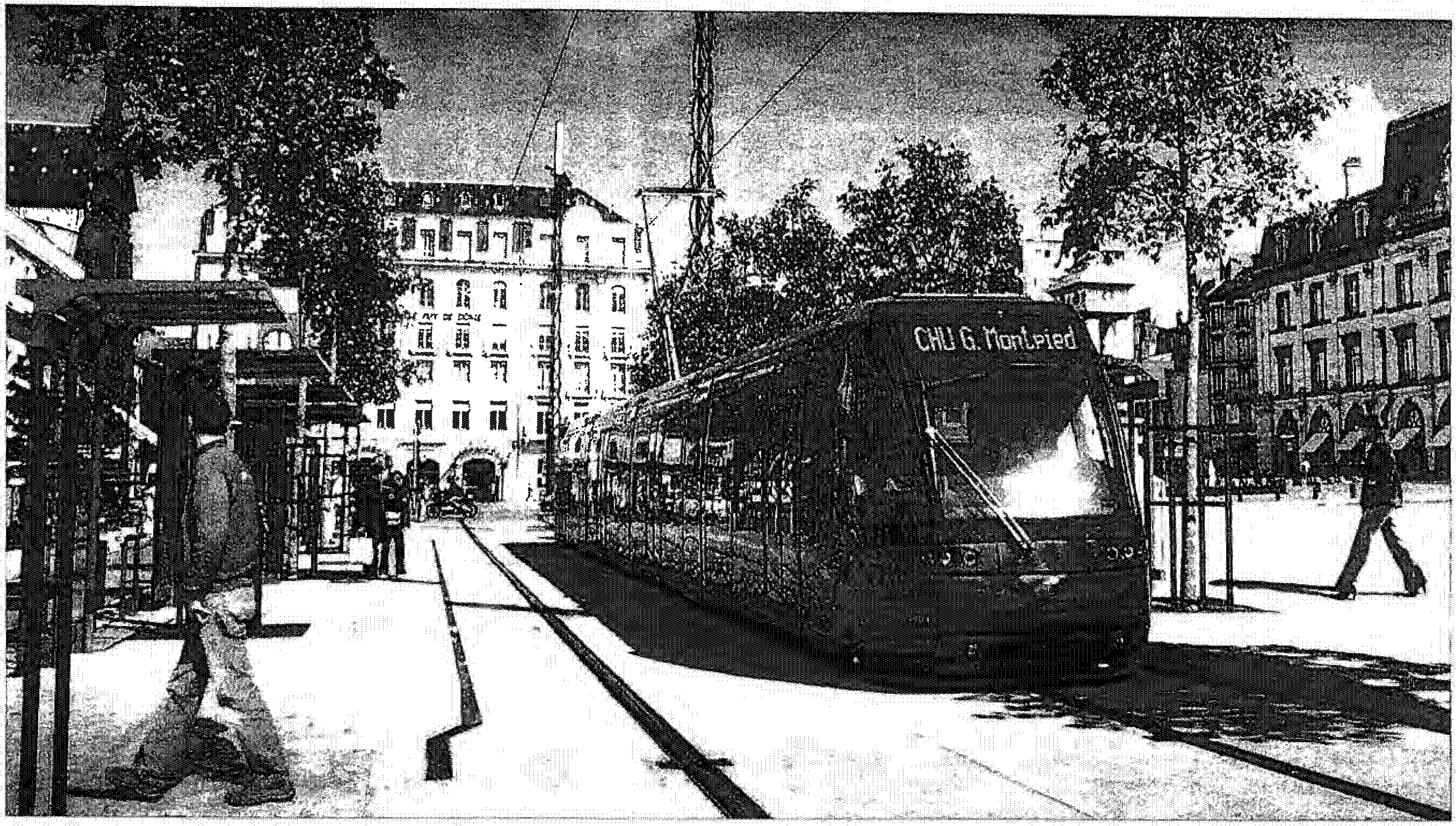

L'Aquila


Mestre-Venice


Tianjin


Translohr range

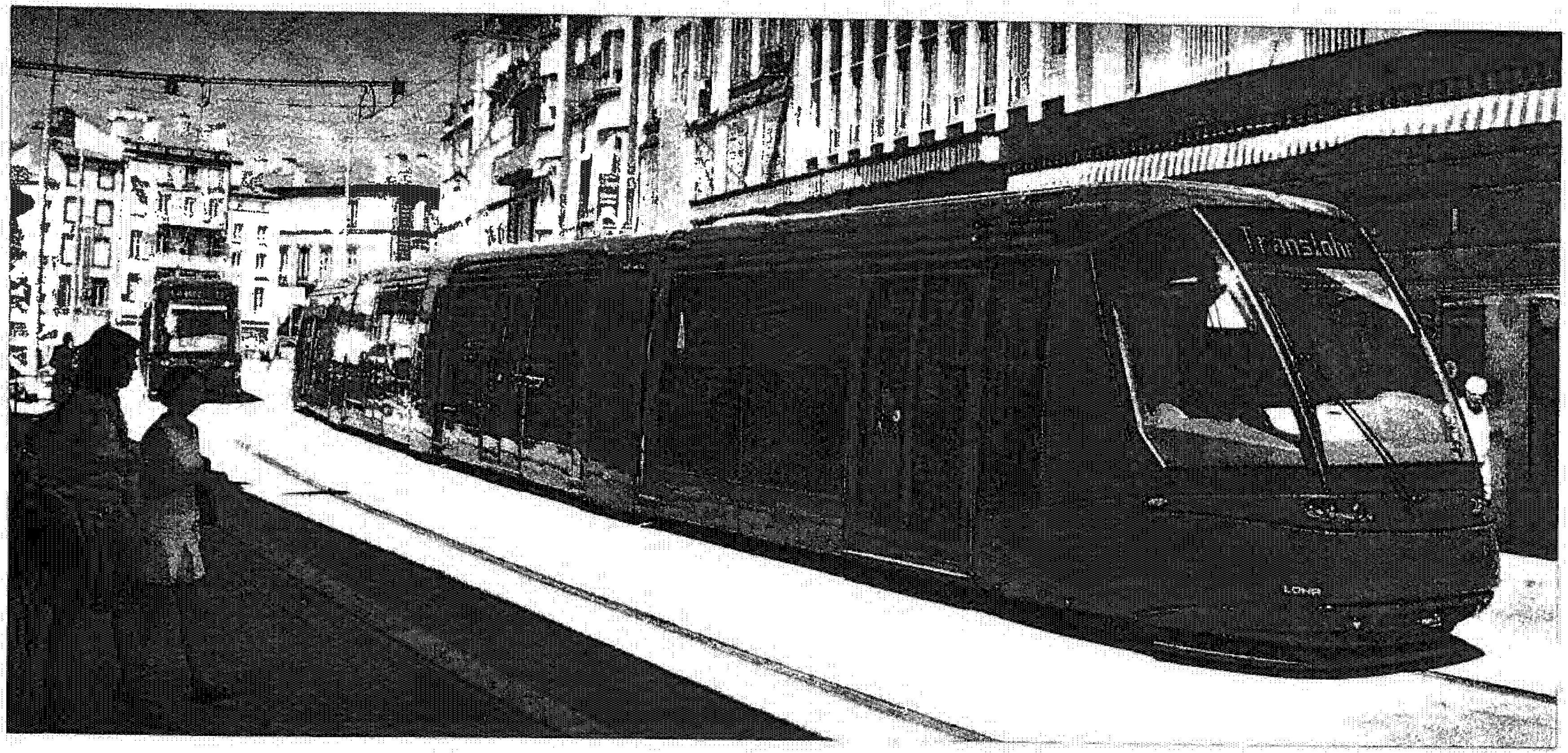
AR00085655



Translohr Tramway on tires - © LOHR - 06/2007

Translohr, Translohr cities

Clermont-Ferrand, France



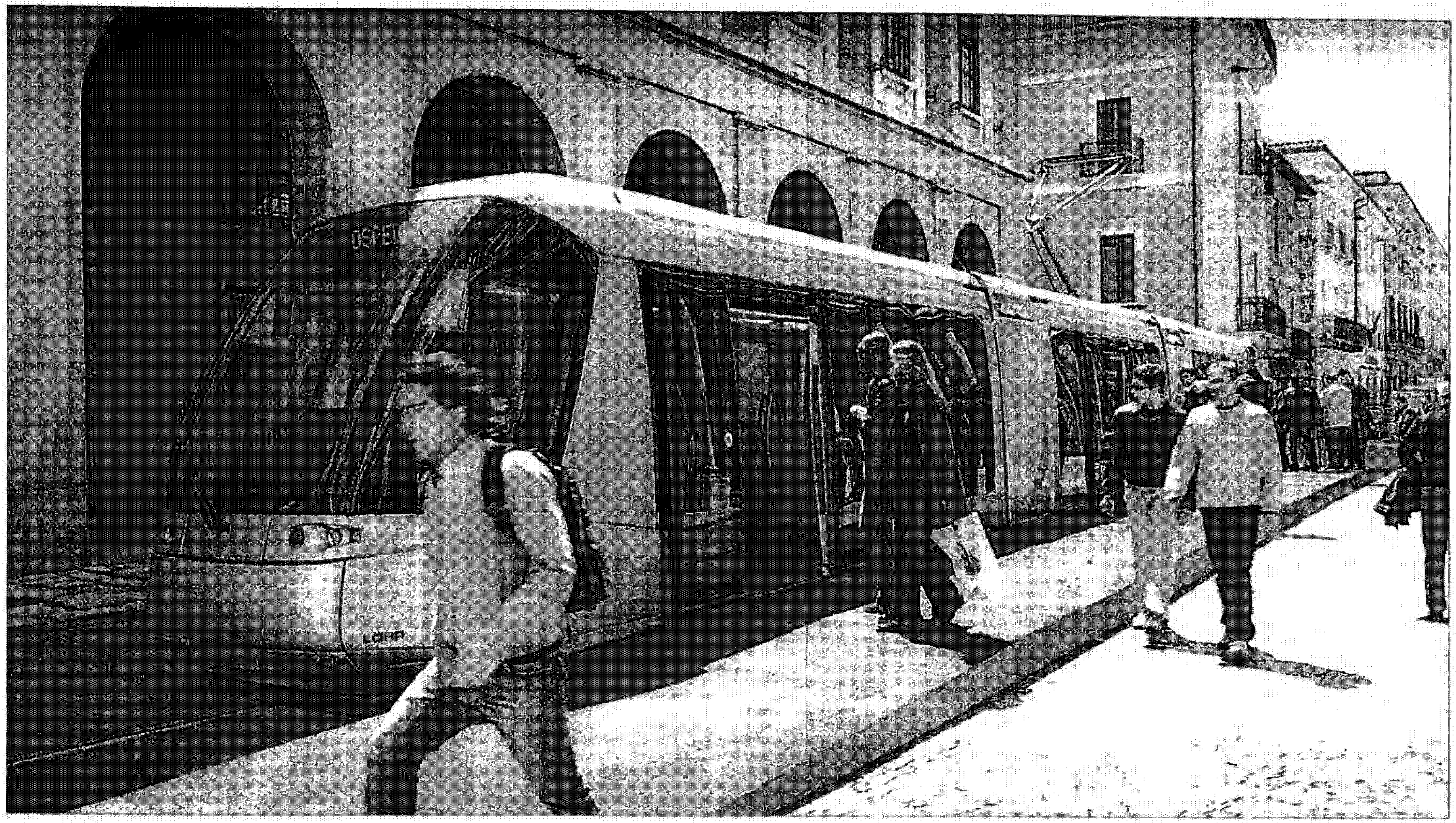
The city of Clermont-Ferrand has chosen Translohr for its new tramway network.
Line 1, with 14 kilometres, crosses the city from north to south. 20 Translohr STE4 are in commercial operation since November 2006.

AR00085657

30 Tramway on brek · © LGHR · 06/2007

Translohr, Translohr cities
Padua, Italy

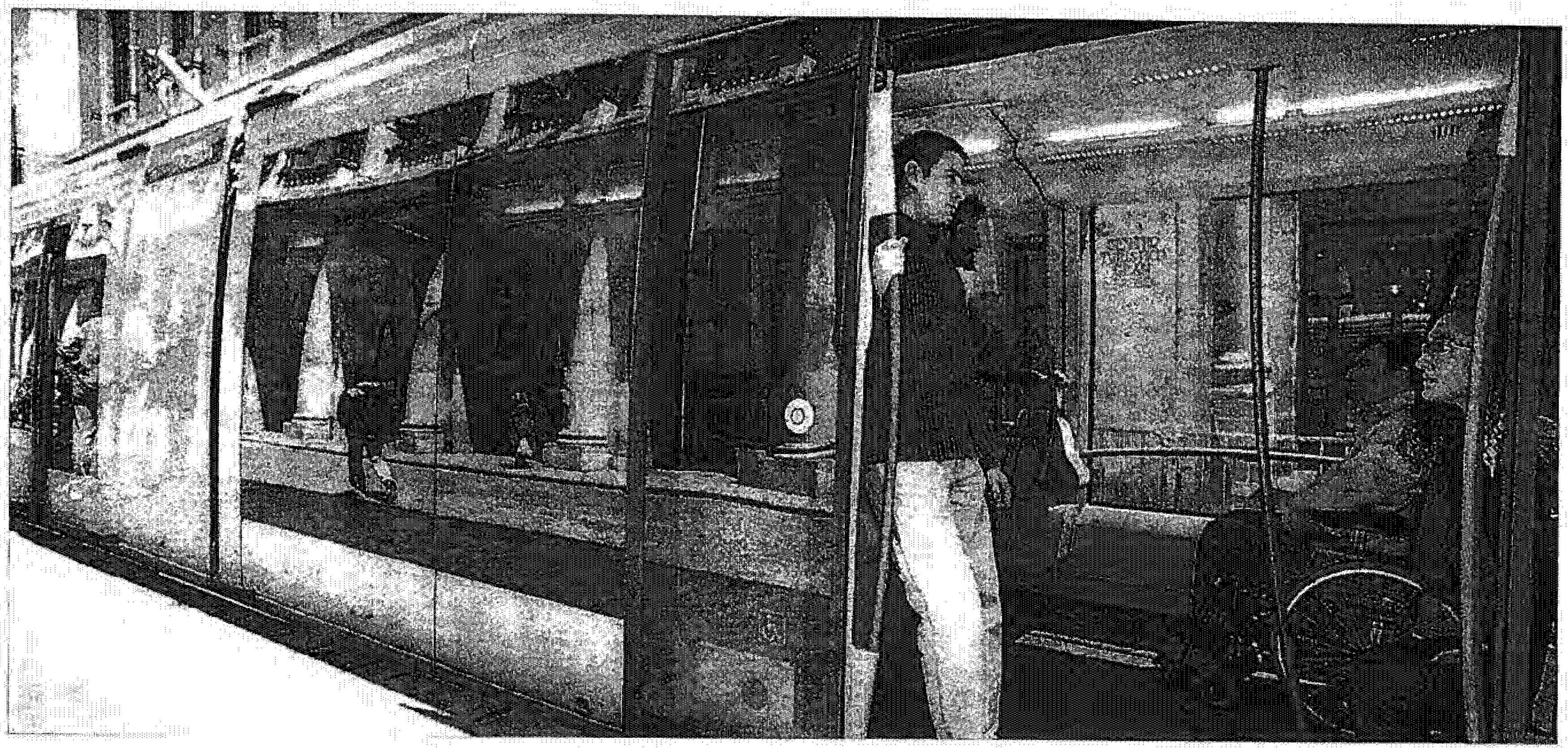
The first line, 10.5 km long, constitutes the backbone of a future network of 3 Translohr lines. The crossing of the main central square Prato Della Valle without catenary is possible thanks to an on-board battery pack (photo). The first line is in commercial operation since March 2007.



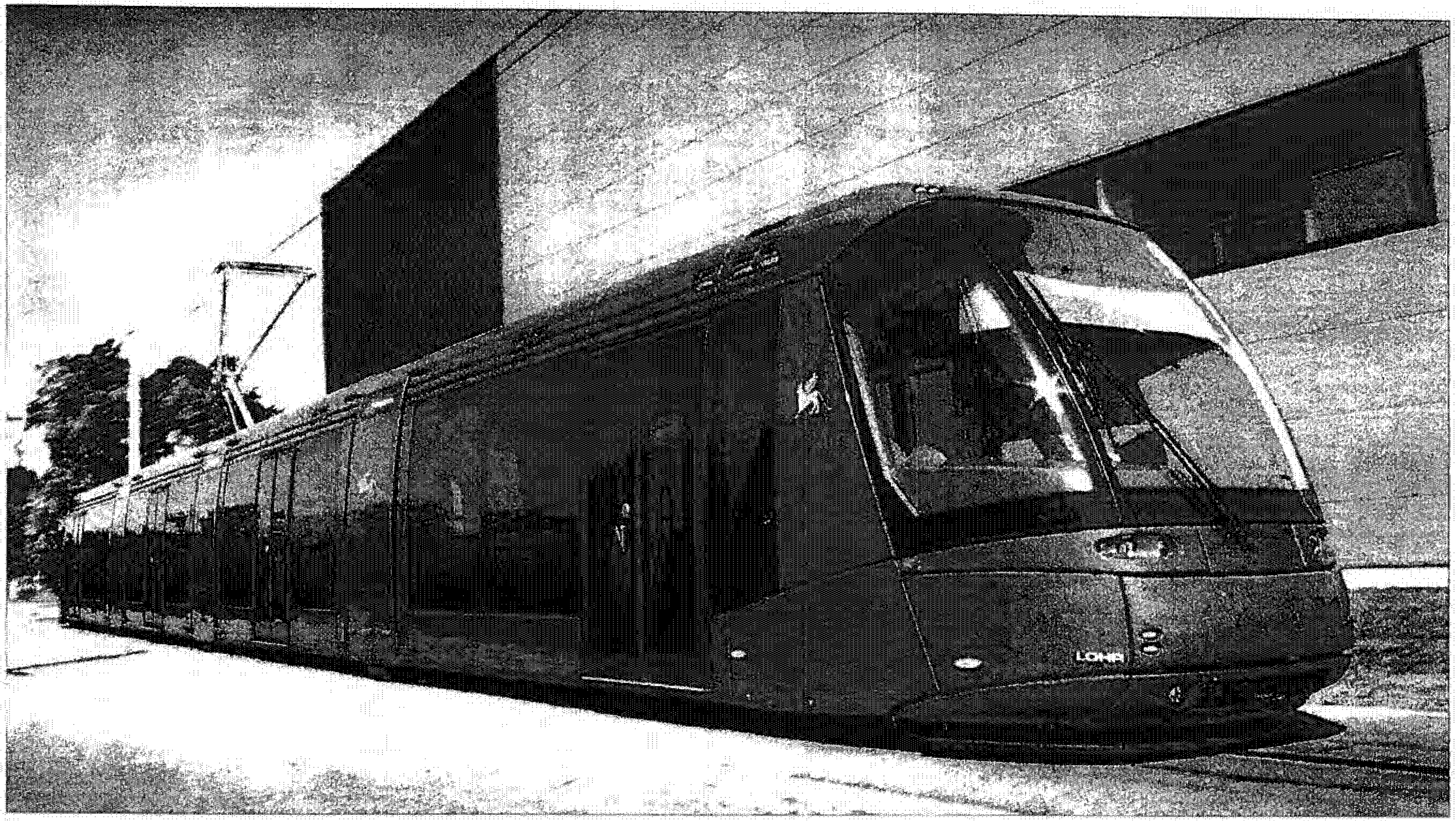
[illegible] : Tramway on tires · © LOHR · 06/2007

Translohr, Translohr cities

L'Aquila, Italy



Translohr is the only tramway able to travel in the winding and steep city center of l'Aquila.
The first line will be ready by 2009.

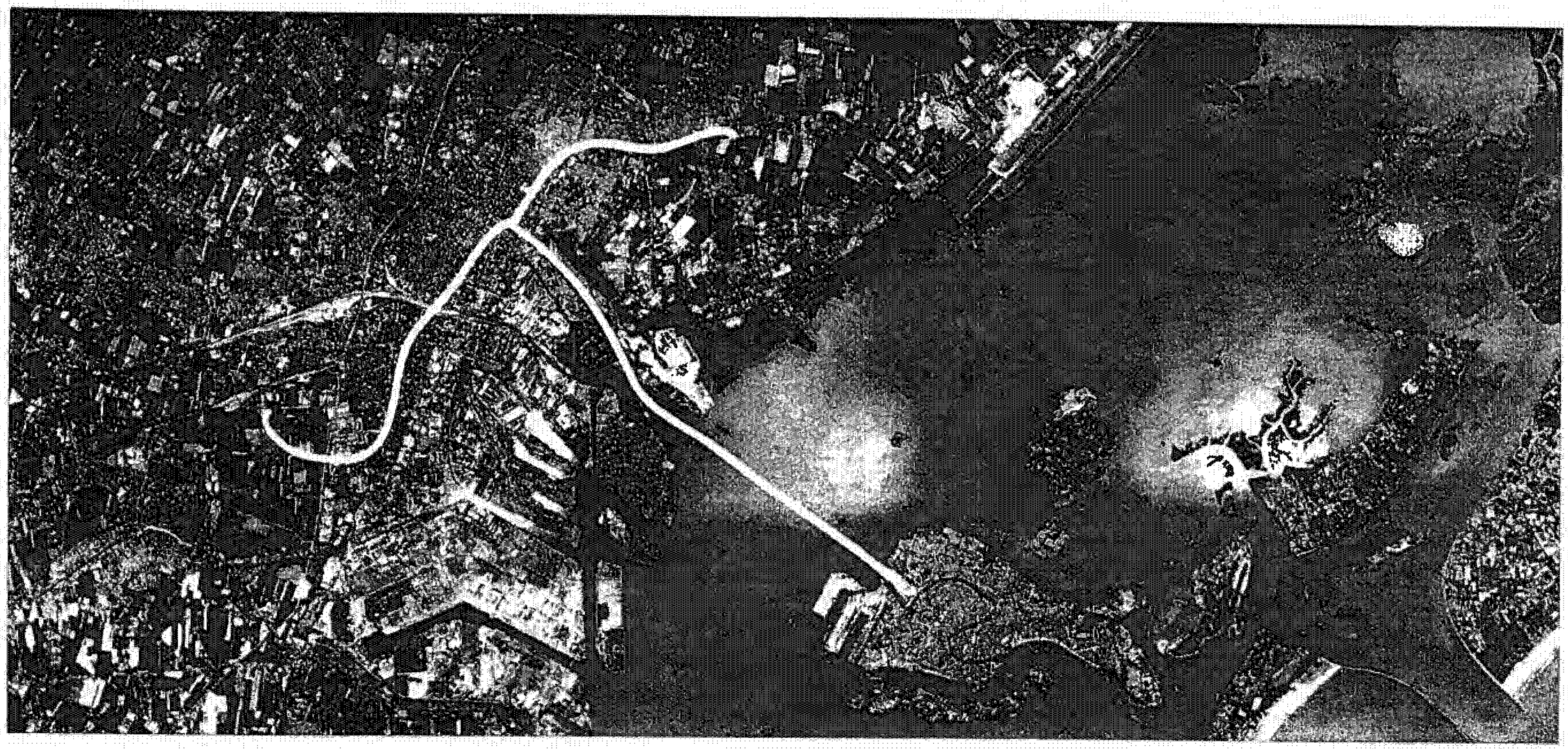


Tramway on tires · © LOHR · 05/2007

AR00085662

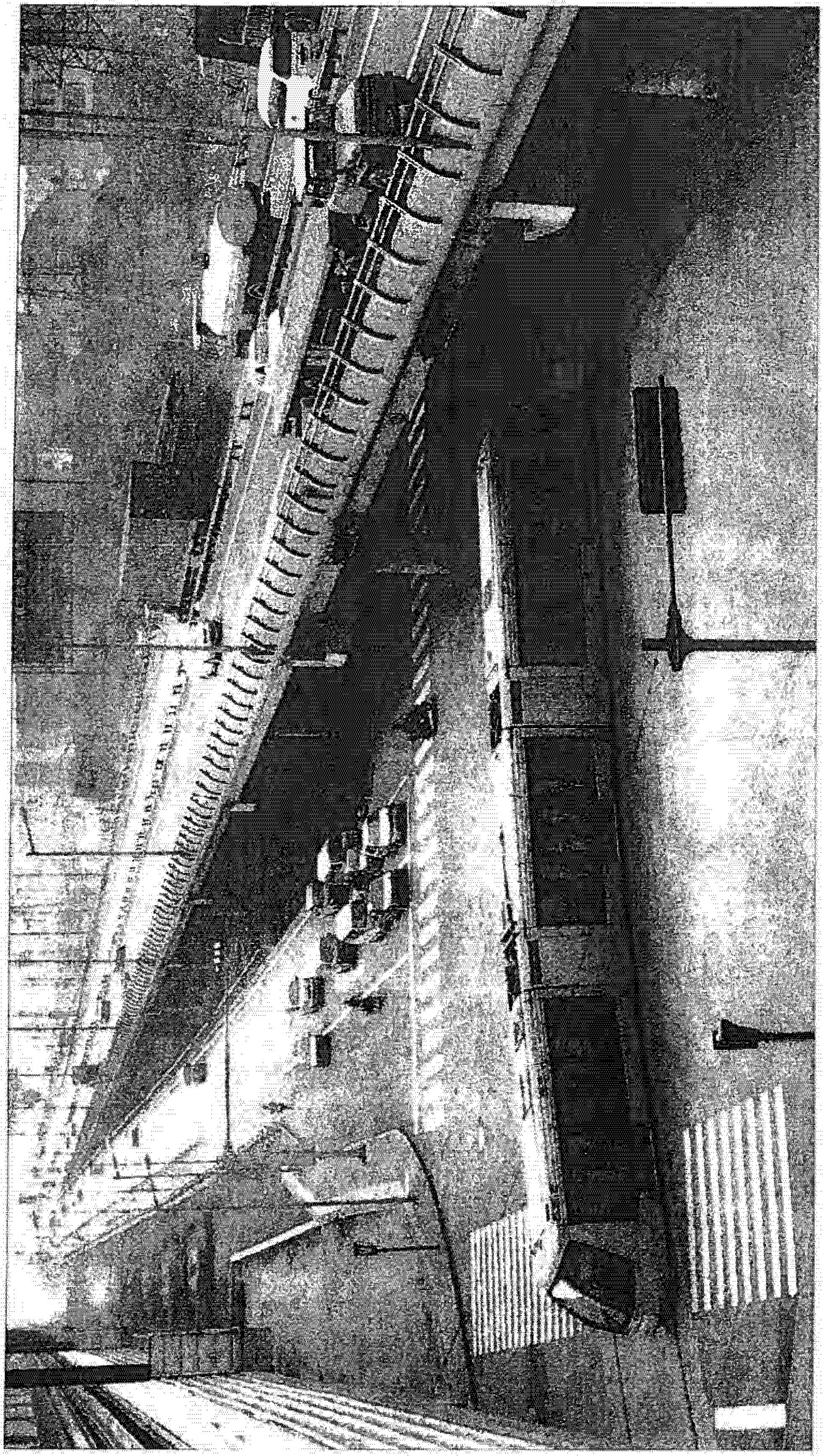
Translohr, Translohr cities

Mestre-Venise, Italy



Translohr has been selected by Mestre-Venice to serve the city on the continent and connect it to the magic city.
20 km line, with 20 Translohr STE4, 32 meters long.

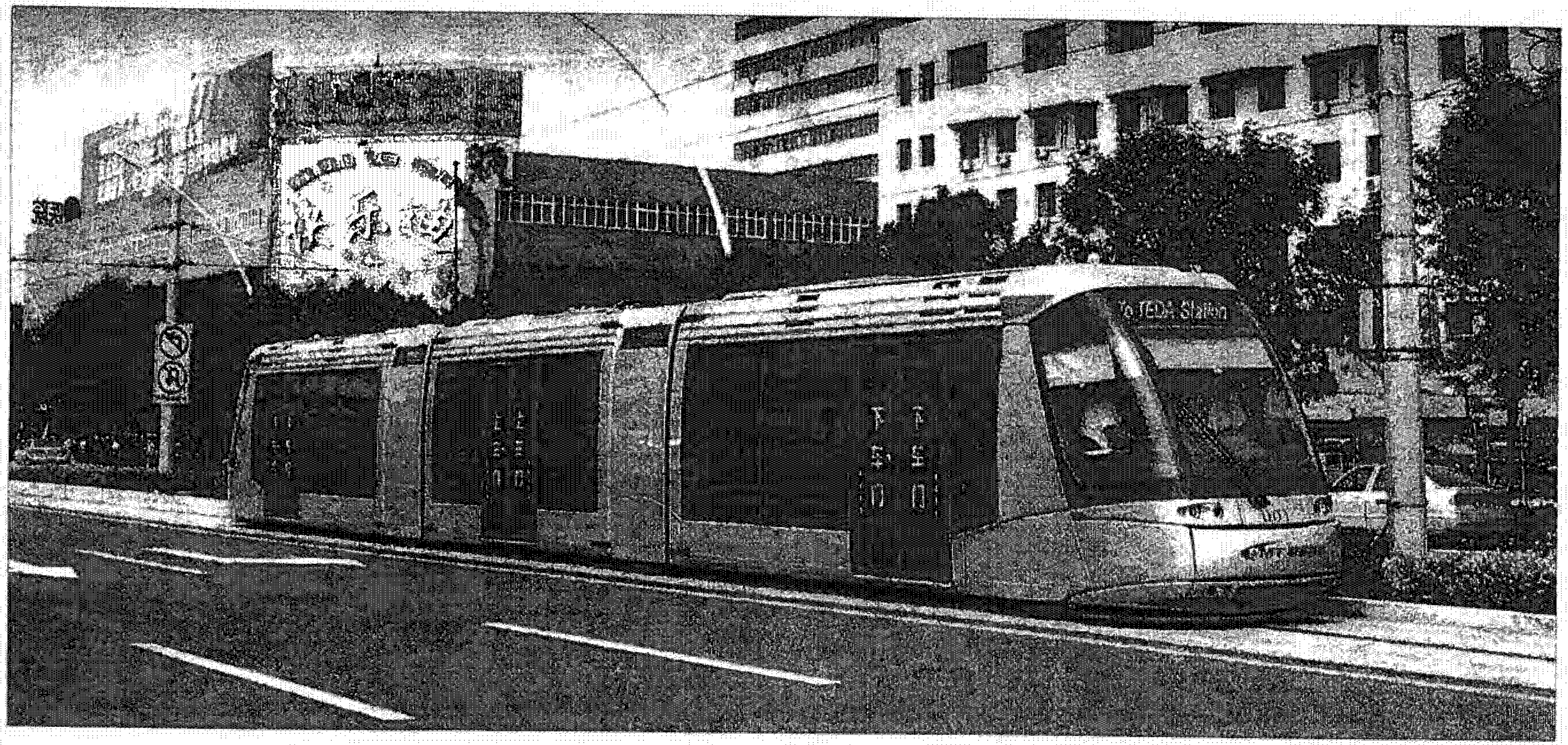
AR00085663



Translohr Tramway on tires · © LOHR · 06/2007

Translohr, Translohr cities

Tianjin - Teda, China



The new city of TEDA (Tianjin Economic Development Area, town of Tianjin) has selected Translohr for its 9 km first line, initiating a future TSCP network of 70 km. In commercial operation since May 2007.

LOHR INDUSTRIE

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Main facilities :
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Thales

Letter with enclosure submitted– not responsive to RFI, and therefore not evaluated by the Technology Selection Panel

THALES

January 10, 2008

Mary Patricia Waterhouse
Division of Purchasing
Department of Budget and Fiscal Services
530 South King Street, Room 115
City Hall
Honolulu, Hawaii 96813

Dear Ms Waterhouse,

Thales Rail Signalling Solutions (US) Inc recently received your Request For Information (RFI) concerning the Honolulu High-Capacity Transit Corridor Project.

Although Thales RSS (formerly Alcatel Transport Automation) is not a vehicle supplier, we are a leading world supplier of automated control systems for fixed guideway systems ranging in project sizes such as airport APMs in Tampa, Newark, and JFK to full transit systems such as Vancouver, San Francisco, London Docklands, Ankara, Hong Kong & Kuala Lumpur. We have interfaced our train control systems to over 20 different vehicle types from numerous manufacturers.

Our response to the RFI is not intended to address the vehicle questions directly (as we are not a vehicle supplier), however I am attaching information on the trends and benefits of our Communication-Based Train Control (CBTC) system. As you will see within this response, our systems will not only increase throughput and decrease headway, it allows for future expansion and energy savings.

Please contact myself if you would like to receive additional information or have any questions.

Sincerely,

Robert A. Sudo
System Engineer
Business Development
Thales Rail Signalling Solutions
5700 Corporate Dr
Suite 750
Pittsburgh, PA 15237

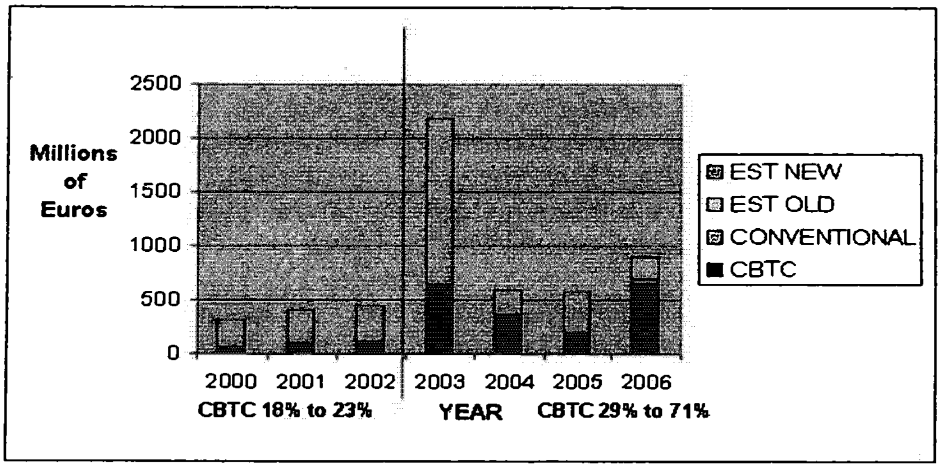
(W) 412-366-8814
(FAX) 412-366-8817

CBTC Trend and Benefits

With the constant pressure to minimize operating costs and the need to bring system improvements on line faster, many transit operators are looking for the flexibility that communications-based (transmission-based) train control (CBTC) technology provides. Answering the call for modern signaling, CBTC presents the opportunity to enhance performance and safety, and lower life-cycle costs.

The CBTC technology segment shows an established trend of preference due to the realized benefits over traditional signaling technology.

CBTC VS CONVENTIONAL TECHNOLOGY PROJECT AWARDS 2000 TO 2006
(All amounts are in Millions of Euros)



Updated on: Feb 28 2007

In Asia, PR China leads in applying advanced CBTC technology to many of their new metro lines, realizing the benefits of the technology over restrictive fixed-block systems.

Only with the addition of much more hardware (i.e. track circuits) can fixed-block systems accommodate increased train frequency. The ability to flexibly manage and operate shorter, yet safe, headways, by virtue of moving-block technology, SelTrac CBTC optimizes throughput and passenger service frequency.

Benefits of CBTC

1. Civil Work Cost Savings
   - Increasing train frequency allows fleet operation with shorter trains, which require smaller platforms and station infrastructure. The result is significant savings in construction costs, and possibly land acquisition costs.

2. Lower Capital and Operating costs
   - Less wayside hardware.
   - Lower hardware and installation costs
   - Lower Maintenance Costs (LCC)
   - Conventional signaling systems must be designed and implemented from the start for the ultimate train configuration.

3. Optimized System Performance
   - Automatic scheduling
     - Less staff reduces administration costs related to staff scheduling
   - Automatically add trains for peak hours, remove trains
     - Double berthing (two trains in platform) for special events or for merging traffic
   - Precision station stopping
   - Allows automatic reduction in performance during off-peak service to reduce energy consumption
   - Repeatable Performance allows tuning to minimize wheel wear and track grinding

4. Increased Safety
   - Removes the possibility of driver error and enforces all signaling rules

5. Increased System Availability
   - Redundant computer configurations.
   - Full, continuous train control allows immediate train performance adjustments to react to system events.

6. Increased flexibility for handling failures or increased service demands.
   - Maximum automatic schedule recovery capability after delays or disruptions.

7. Easily add to fleet size
   - New trains can be added to the network as they become available.
   - SelTrac Train Control system has been installed on all current Rolling Stock from a variety of suppliers including but not limited to: Bombardier, Siemens, Rotem, Kawasaki, Alstom, Ansaldo, Chang Chung, Mitsubishi.

8 Automated Yard
   - Increase customer service with same or reduced staff levels.

- Number of yard personal required is minimized as trains are moved automatically in and out of service or to maintenance areas.
    - Automatic close up within lane reduces length of track required and overall geographic area required for yard, significantly reducing infrastructure costs

- Automatic Car Wash
    - More trains per hour can be washed with reduced staff minimizing costs

- Efficient Utilization of Train Storage Lanes
    - Automatic close up within lane reduces length of track required and overall geographic area required for yard, significantly reducing infrastructure costs
    - Automatic shuffle up of trains within lanes reduces staff and associated costs
    - Trains automatically routed to and from pre-defined storage lanes ensures overall system availability and on time performance

- Automatic Storage Mode leads to Energy Savings
    - Trains are automatically commanded to de-energize power consuming train subsystems, reducing yard energy demand and equipment life cycle costs

- Automatic train re-configuration to accommodate service levels
    - Advanced Identification of Failed Trains
    - Automatic start up and test before trains enter service allow for timely train re-configuration, minimizing service disruptions and increasing overall availability and on time performance.
    - Automatic failure notification to Maintenance staff reduces time to repair
    - Number of yard personal required is minimized as trains are moved automatically in and out of service or to maintenance areas

9. Future line expansion
    - The line will be designed with the required interfaces and capacity to allow for future expansion.
    - As an example, Vancouver's Driverless Skytrain has been extended four times over a period of 20 years. The current extension work will take the network to over 50KM .

10. Energy Benefits
    - Optimized System Performance – CBTC allows automatic reduction in performance during off-peak service to reduce energy consumption. Automatic storage mode leads to further energy savings – as trains are automatically commanded to de-energize power consuming train subsystems, reducing yard energy demand and equipment life cycle costs.
    - Traction Power Optimization - The system can optimize the usage of power particularly when the vehicles are equipped with regenerative braking systems. As well, the schedule can be optimized to match acceleration and braking of different vehicles in order to reduce the power demand per traction power segment area.
    - Advanced Power Optimization - With additional information on passenger loading, etc, the velocity profiles and power utilization of the trains can be more accurately modeled and the power optimization can be more finely tuned.

End of Book